STATE OF WASHINGTON
DEPARTMENT OF NATURAL RESOURCES

SMOKE MANAGEMENT PLAN

1993
(Revised 1998)

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INTRODUCTION

The people of Washington State care about the quality of our air. In response to that concern, the Department of Natural Resources (DNR), Department of Ecology (DOE), U.S. Forest Service (USFS), National Park Service (NPS), Bureau of Land Management (BLM), participating Indian nations, military installations (DOD), and small and large forest landowners have worked together to deal with the effect of outdoor burning on our air.

Protection of public health and preservation of the natural attractions of the state are high priorities with the DNR and can be accomplished along with a limited, but necessary, outdoor burning program. Public health, public safety, and forest health can all be served through the application of the provisions of Washington State law and this plan, and with the willingness of those who do outdoor burning on forest lands to further reduce the negative effects of their burning.

This plan pertains to DNR-regulated silvicultural (forest land) outdoor burning only and does not include agricultural outdoor burning or outdoor burning that occurs on improved property. Although the portion of total outdoor burning covered by this plan is less than 10 percent of the total air pollution in Washington, it remains a significant and visible source. (Source: DOE "Clean Air Washington" fact sheet pamphlet, May 1991.)

Background

Washington State has had a Smoke Management Plan in effect since 1969. After the enactment of the original plan, and with the addition of the 1975 plan, the number of smoke intrusions into designated population areas has dropped significantly every year.

The 1975 Smoke Management Plan has undergone several informal and semi-formal modifications since its adoption, mainly by agreement with the plan's signatories and other agencies. These modifications represent significant changes in DNR operating procedures and emphases.

Some notable changes to the 1975 Plan have included:

- the addition of a professional Meteorologist to the Smoke Management Program to provide accurate meteorological information and forecasts to Regions to facilitate burn approval decisions;
- the close relationship and daily consultation with the Washington State DOE when burning is taking place;

- increased concern by DNR Region staff that outdoor burning only occur when it will not produce nuisance and negative public health effects; and

- the willingness of large forest companies to enter into voluntary agreements to limit burning that exceeds the existing State Implementation Plan (SIP) for visibility protection of Class I federal areas.

The earlier Smoke Management Plans of 1969 and 1975 have done their job well. Today the Pacific Northwest is regarded as a leader in controlling smoke from outdoor burning on forestlands; many other states have used our past plans as models in setting up their own smoke management programs. Now, with this latest plan, we begin a new chapter in smoke management in Washington.

The 1995 revision of the Smoke Management Plan reflects:

- organizational changes to the DNR;

- legislation directing that burning shall be prohibited when alternatives are available, reasonably economical, and less harmful to the environment;

- legislation acknowledging the role of fire in forest ecosystems and finding it to be in the public interest to use fire under controlled conditions to prevent wildfires by maintaining healthy forest and eliminating sources of fuel;

- legislation exempting burning conducted for the purpose of restoring forest health or preventing the additional deterioration of forest health from the reduction targets and calculations of the Washington Clean Air Act.

Purpose

The purpose of this plan is to coordinate and facilitate the statewide regulation of prescribed outdoor burning on lands protected by the DNR and on unimproved, federally-managed forest lands and participating tribal lands. Written under the authorities listed in Appendix 11, the plan is designed to meet the requirements of the Washington Clean Air

Act (RCW 70.94), Forest Protection laws (RCW 76.04), and the United States Clean Air Act (42 USC 7401 et seq.).

Goals

- Protect human health and safety from the effects of outdoor burning

- Facilitate the enjoyment of the natural attractions of the state
- Provide a limited burning program for the people of this state

- Provide the opportunity for essential forest land burning while minimizing emissions

- Reduce emissions from silvicultural burning other than for forest health reasons first by 20 percent and later by 50 percent, as required by law

- Foster and encourage the development of alternative methods for disposing, of or reducing the amount of, organic refuse on forest lands

- Acknowledge the role of fire in forest ecosystems and allow the use of fire under controlled conditions to maintain healthy forests.

Scope

This plan provides regulatory direction, operating procedures, and advisory information regarding the management of smoke and fuels on the forestlands of Washington State. It applies to all persons, landowners, companies, state and federal land management agencies, and others who do outdoor burning in Washington State on lands where the DNR provides fire protection, or where such burning occurs on federally managed, unimproved forestlands and tribal lands of participating Indian nations in the state.

This plan does not apply to agricultural outdoor burning and open burning as defined by Washington Administrative Code (WAC) 173-425-030 (1) and (2), nor to burning done "by rule" under WAC 332-24 or on non-forested wildlands (e.g., range lands). All future reference to burning in this plan will refer only to silvicultural burning unless otherwise indicated.

The plan does not address nor attempt to regulate prescribed natural fire in wilderness areas and national parks for several reasons: the amount of emissions caused by such burning in this state is relatively small, it is impossible to "regulate" unforecastable natural ignitions, and it is nearly impossible to gather emission data efficiently in the areas where this type of burning generally takes place. Federal agencies that have adopted the use of prescribed natural fires will remain solely responsible for the administration of such programs.

The plan is supplemental to the forest fire protection laws of Washington State (RCW 76.04) and the Clean Air Acts of Washington State (RCW 70.94) and the United States (42 USC 7401 et seq.). If there is any contradiction between the requirements of this plan and statutes, the statutes will prevail.

PARTICIPATION

Those who receive fire protection from the DNR, or from agencies contracted by the DNR, must abide by the requirements of this plan. This includes all burning done on private and state-managed lands that pay, or are subject to paying, Forest Protection Assessment.

Federal agencies that do outdoor burning on forest lands must participate in and abide by the requirements of this plan under the direction of the federal Clean Air Act. These agencies include, but are not limited to, the Forest Service (USFS), Park Service (NPS), Fish and Wildlife Service (F&WS), Bureau of Land Management (BLM), and Department of Defense (DOD).

Indian nations may choose to participate in all or portions of the plan. Participation would be by written agreement between the Indian nation and the DNR. Advantages of participation by Indian nations would include statewide coordination of burning, shared weather forecasting services, uniform data reporting and storage, better protection of the public through a unified burn approval system, satisfaction of federal EPA requirements, and other services provided by either party to the other. Such future agreements would become appendices to this plan.

The "Directives" listed in this plan are requirements of Washington State Law Chapter 70.94 RCW, 76.04 RCW, and WAC 332-24.

ADMINISTRATION

Administrative Units

Individual administrative units of this plan are: DNR Region, National Forest, National Park, National Wildlife Refuge, Military Base, BLM-Spokane District, and Indian nation (if applicable). Working through these administrative units will make efficient use of existing organizational structures and facilitate implementation.

Permit issuance, plan enforcement, and plan administration will be based upon these administrative boundaries, but individual burn approvals will consider the cumulative effects of all burning to avoid severely affecting individual air sheds.

Responsibilities

The *DNR* is responsible for the overall administration of the Smoke Management Plan. The Resource Protection Division Manager delegates operating responsibilities to the DNR Regions. Other agencies in both the state and federal governments also have responsibilities under the plan, as discussed further in this section. (See the Appendices for specific operational responsibilities.)

The *Resource Protection Division Manager* is responsible for:

- Providing smoke management operating procedures for the DNR Regions and federal land managers
- Providing technical expertise, meteorological information and forecasts, and training related to this plan
- Developing performance standards for DNR Regions
- Coordinating among Smoke Management Plan participants
- Approving or disapproving burning depending upon meteorological conditions, potential smoke intrusions, and other air quality effects.
- Developing and maintaining systems for gathering, transmitting, and reporting data required by the plan (excluding computer software and hardware)
- Collecting required fees from federal Smoke Management Plan participants (and Indian nations where applicable)

DNR *Region Managers* are responsible for:

- Implementing the Smoke Management Plan on state and private lands that receive fire protection from the DNR
- Approving or disapproving burning on state and private lands that receive fire protection from the DNR

- Ensuring that DNR standards and operating procedures are followed
- Assigning priorities for burning on state and private lands
- Providing necessary information and required data to Resource Protection Division
- Collecting permit fees from state and private burners
- Reporting and documenting where and when smoke intrusions occur, and reacting to citizen complaints about smoke nuisances
- Coordinating plan implementation with local fire districts and local air pollution control authorities
- Ensuring that field enforcement is conducted and is consistently applied

The *Director of the Washington State DOE* is responsible for establishing "Designated Areas" and establishing and publishing air quality standards (see Appendix 10). The director also gathers air quality information from DOE sources and from local air pollution control agencies, and notifies the DNR when air quality has diminished to the point when "impaired air" or a "forecast stage of air pollution episode" have been, or are likely to be, declared. DOE confers with the DNR meteorologist as needed during the daily burn approval process. DOE is also responsible for creating the State Implementation Plan (SIP) for visibility protection of Class I federal areas.

The following officials are responsible for ensuring that the requirements and operating procedures of this plan are met as they apply to burning on federal lands under their control: the Forest Supervisor for the USFS, the Park Superintendent for the NPS, the Refuge Manager for the F&WS, the District Manager for the BLM, and the Base Commander for the Military Base.

Where there is an agreement between the DNR and an Indian nation over burning on tribal forest lands, the tribal designee or government body specified in the agreement will be responsible for ensuring that all requirements and operating procedures are met.

Annual Reporting

The DNR will provide an annual report to the legislature, DOE, and other interested parties that details the total emissions created by all burning included within the scope of this plan, other burning statistics and trends, and the progress made toward meeting the emission reduction targets of the Washington Clean Air Act.

GENERAL BURNING REQUIREMENTS

All burning **must be approved before** lighting the fire. The mechanism, criteria, and requirements for burning approval are different for large fires than for small fires.

General Directive:

All persons who do any burning that is subject to this plan must comply with the following general requirements:

Burning is allowed only if the fires do not contain prohibited materials as defined in WAC 332-24-205 (7), unless otherwise provided for in this plan.

Smoke from burning must not obscure visibility on public roads and highways.

Smoke from burning must not cause a nuisance as defined in WAC 332-24-205(8).

APPROVING LARGE FIRES

Large prescribed fires have specific approval criteria that represent current practice in the burn approval process.

Large fires defined:

Large prescribed fires are fires that have the potential to create significant smoke impacts beyond the immediate fire area. The threshold for what makes up a large fire varies by geographic area, topography, and distance to communities. In areas near communities or prone to inversions the threshold will be 100 tons per burn. DNR Regions will use the criteria described in Appendix 18 to identify low risk areas where the threshold for pile burns will be set at 300 tons per ownership per DNR District.

Judgment, experience, science, and local knowledge have been successfully combined to produce an effective burn approval system. The appropriate weighting of factors in an ever-changing environment is the art of smoke management, and has been responsible for the program's success in the last nine years. A measure of the effectiveness of these criteria is that since implementation of the plan there have been very few intrusions of smoke into designated areas.

Burn Approval Criteria:

1. There is the likelihood of an "intrusion" of smoke into "designated areas," which includes air space 2,000 feet above the ground, or "sensitive areas," such as population centers (see map, Appendix 8).

2. There is any likelihood of an over-flight of smoke above a designated area or special public events specified by DNR Region Managers; but over-flights of smoke may be approved over designated areas on days when visibility would be reduced naturally by clouds, fog, rain, snow, etc.

3. Burning will not comply with the SIP of the federal Clean Air Act regarding visibility protection of Class I federal areas (see map, Appendix 7).

4. Any state or federal air quality regulations, laws, or rules would be violated.

5. Burning on state and private lands does not meet the requirements of Washington State's Forest Practice Rules and Regulations relating to threatened or endangered species protection.

6. Burning will cause mandatory emission reduction levels to be exceeded as described in this plan on page 13.

7. Burning will knowingly violate another state's published air quality standards.

8. Smoke will not significantly disperse within approximately eight hours of ignition, and be fully dispersed by 12:00 PM the next afternoon unless the burn meets the criteria and requirements of a multiple day burn. This does not include residual smoke in the immediate burn area itself.

There are several important factors considered by DNR Regions and the Smoke Management Section of Resource Protection Division to determine if the preceding criteria can be met.

Current and forecasted air quality are important factors in the burn approval process. The DOE's Meteorologist transmits air quality conditions to the DNR. The DNR's Smoke Management Meteorologist uses DOE-supplied data, along with National Weather Service observations and information supplied by local air pollution control agencies, to evaluate air quality. If air quality is deteriorating and is expected to continue to deteriorate and result in an episode being called in the next 24-hour period, burns greater than 100 tons are usually denied until conditions improve.

Current and forecasted weather conditions also have a direct influence on all burn approvals. The DNR's Smoke Management Meteorologist makes daily smoke management forecasts using data from the National Weather Service, the Forest Service, DNR Regions, and private industry sources. Wind speed and direction are both observed and predicted at various elevations above ground level. Air turbulence, mixing heights, inversion depths, and smoke dispersion potential are all considered in the smoke management forecast and the approval process.

Burn approvals will include consideration of ***dispersal criteria and objectives,*** that is, of an air shed's ability to disperse the pollutants created by burning. The Smoke Management Section predicts large-scale dispersion potential and Regions include local knowledge of inversion and local dispersal patterns for individual burn sites.

Fuel moistures, timing of ignition, and the firing method are reviewed before issuing burn approvals. These factors relate to minimizing particulate emissions and the impacts of residual smoke on and around the burn site. Those burns that apply the best technology and firing techniques may receive a higher priority than other similar proposed burns using less-efficient-firing techniques.

In the approval process, the DNR Region Managers consider the ***availability of suppression forces*** to react to potential prescribed burn escapes on DNR-protected lands. They also consider the level of wildfire activity in the Region. Units deemed to be "high risk" on DNR-protected land warrant special attention. Weather factors relating to fire danger, such as wind speed and relative humidity, are important considerations when evaluating the risk of escape.

DAILY BURN PRIORITIZATION

For large prescribed fires (described on page 7), the DNR Region Managers and the various federal managers to which this plan applies will pre-approve and prioritize burns daily, and then submit those prioritized pre-approvals to the Smoke Management Section. The Smoke Management Section will in turn approve or disapprove each burn and notify the affected manager of the decision. The managers must then consider the following factors when they give **final** approval to those burns authorized by the Smoke Management Section:

Elimination of fire hazard or "extreme fire hazard" as defined in WAC 332-24-650 and WAC 332-24-652.
Burning conducted in eastern Washington for the purpose of restoring forest health or preventing the additional deterioration of forest health as determined by the Department.

Burning to maintain fire dependent ecosystems to preserve rare or endangered plants or animals within state, federal, and private natural area preserves, natural resource conservation areas, parks and other wildlife areas.

Burns using burning techniques that will produce the least particulate emissions per acre treated, as predicted by the USFS PNW Research Station computer model (see page 15).

Proposed burns from landowners who have an active program of using alternative slash management techniques.

Whether fire is the only viable tool to accomplish the fuel reduction, silvicultural practice, or other purpose for proposing burning.

The risk of smoke intrusion.

Directive: No large prescribed fires will be permitted on

State, private, federal and participating tribal lands that ARE protected by the DNR

unless

the Department's Resource Protection Division, Smoke Management Section, has given smoke management approval,

and

the Region Manager where the burning is proposed issues the final approval.

Directive: No large prescribed fires will be permitted on

federally managed and participating tribal lands NOT protected by the DNR

unless

the Department's Resource Protection Division, Smoke Management Section, has given smoke management approval,

and

the responsible Land Manager where the burning is proposed issues the final approval.

Directive: This plan requires that the specific operating procedures listed in Appendix 1 be used in requesting and granting individual burn approvals.

APPROVING SMALL FIRES

Small fires have the potential to affect public health when state or local authorities declare air pollution episodes and impaired air conditions. State law requires that burning be suspended in areas where episodes or conditions of impaired air have been declared.

Small fires defined:

small fires are individual fires that consume less than 100 tons of material in a 24-hour period, or one or more fires totaling less than the level defined in Appendix 18.

Directive: All persons who propose to burn small fires must first call 1-800-323-BURN and follow the instructions that apply for the day and location of the proposed burning.

If the message suspends burning because of poor air quality, all participants of this plan must comply. If burning is suspended because of high fire danger, then this suspension applies only to DNR-protected lands. (Federal Land Managers can establish their own criteria for suspension of burning because of high fire danger on lands they protect.)

APPROVING MULTIPLE DAY BURNS

A multiple day burn is a prescribed fire of any size conducted in eastern Washington for forest health purposes that cannot be managed so that the smoke will be fully dispersed by 12:00 p.m. on the day after the first ignition of the burn area. Burns that the landowner chooses to ignite over several days, but could reasonably be burned in one day or managed on a day by day basis will not be considered multiple day burns. Large pile burns burned over a period of days are not multiple day burns because ignition can be stopped and the piles mopped up, if needed.

Multiple day burns, regardless of size, will be approved following the criteria for approving large burns described on page 7. The following notification requirements must be met to provide DNR adequate time to review the project, and to inform other interested agencies and the public of the burn.

Beyond the other criteria used to approve large burns, The DNR will consider whether other burners in the area will have the opportunity to burn during the multiple day burn.

Notification Requirements for multiple day burns

- Three months before the burn the landowner must give the DNR sufficient burn plan information to determine the size and scope of the proposal for DNR's review.

- Two months before the burn DNR will determine if the burn has the potential to

significantly affect communities, and will notify the landowner of additional steps needed.

- If DNR determines that the burn has the potential to affect communities, the landowner must notify the public of the burn at least one week before they plan to burn. The notification will be published in local newspapers, and may be a paid advertisement, press release, or public service announcement. The notice will list the location, size and duration of the burn, and must include a landowner's phone number to call for updates or more information about the burn.

SMOKE INTRUSIONS

There may be occasional intrusions of smoke into designated areas. The DNR Region staff and Resource Protection Division are responsible for complaint processing and intrusion reporting as described in the procedures in Appendix 5. Documentation of such occurrences will improve future prevention measures and properly inform responsible officials and the public.

VISIBILITY PROTECTION

The federal Clean Air Act (CAA) established a national visibility goal to ". . . prevent any future, and remedy any existing, impairment of visibility in mandatory Class I areas." Washington has eight (8) federal Class I areas that are national parks and wilderness areas (see map, Appendix 7).

All states must develop programs to make "reasonable progress" toward meeting the visibility goals in the Class I areas as part of its State Implementation Plan (SIP) for the federal Clean Air Act. The Washington State DOE has the primary responsibility for SIP development, with the DNR being responsible for enforcing the portions related to its jurisdiction.

One or more burns that consume 100 tons or more of material have the potential to affect visibility significantly over large areas. The cumulative effect of many smaller burns may also have an impact on visibility. The visibility portion of this plan concentrates on burns that consume 100 tons and greater at this writing. Added control of small burns may be included in future plan amendments if that source is a significant contributor to visibility degradation, and if workable implementation thresholds can be established.

The visibility protection section of the current SIP was created in 1985 after consultation with DNR, USFS, private landowners, DOE, and other stakeholders. Presently, visibility protection practices meet or exceed the requirements of the 1985 SIP, mainly because of voluntary agreements between large private landowners and the DNR.

In 1991, the Washington Clean Air Act amendments (RCW 70.94.011; Declaration of Public Policies and Purpose) added language describing the legislature's intent to ". . . preserve visibility, to protect scenic, aesthetic, historic, and cultural values, and to prevent air pollution problems that interfere with the enjoyment of life, property, or natural attractions of the state." This, combined with the federal visibility requirements, has motivated many stakeholders and the managers of Class I federal areas to ask for increased visibility protection beyond the 1985 SIP requirements and the current operating level developed through the voluntary agreements.

The following provisions of this plan will be another significant step toward making "reasonable progress" to meet national visibility goals for Class I federal areas, and will balance the needs of

various stakeholders in meeting the intent of the legislature as stated in the Washington Clean Air Act amendments of 1991:

Reduced particulate emissions due to the mandatory emission reductions described in this plan and RCW 70.94.

Restricted burning during poor air quality days, which are also the days that have generally poor visibility conditions, due to implementation of the mandatory "call-in" requirement before igniting burns of less than 100 tons.

Increased use of alternative methods of debris disposal to reduce the need to burn forest debris.

Increased use of "pile-burning" techniques to reduce visible smoke by increasing combustion efficiency through the use of fans, etc. The use of pile-burning techniques will also allow burning to occur outside heavy tourism periods when broadcast burning is not possible, allow burning of large units to be done in smaller sub-units (thereby keeping smoke impacts more localized), and will allow burning during cloudy or low visibility rainy days.

Directive: Burns that will consume 100 tons or more of material will NOT be allowed under the following circumstances:

On weekends (midnight Thursday through midnight Sunday) between June 15 and October 1 statewide

On Independence Day or Labor Day holidays.

All burning on weekends between June 15 and October 1 in western Washington west of Interstate 5 may be approved by the Land Manager on a case-by-case basis if:

the burn will meet all of the eight criteria for burn approval described on page 8

and

the burn is a high-priority unit for abatement of extreme hazard if required by law,

or

the Land Manager determines that annual burning opportunities on a particular site are so limited as to justify an exception.

Multiple day burns conducted between June 15 and October 1 in eastern Washington may be approved by the land manager on a case-by-case basis if the land manager certifies in writing to the Department of Ecology that:

the burn is conducted to restore or maintain forest health, as defined in appendix 16,

and

the burn will meet all of the eight criteria for burn approval described on page 8,

and

the burn could not be conducted prior to June 15 due to unfavorable weather conditions

and

smoke impacts to Class I areas can be avoided and such consideration is included in the prescription for the burn. The burn plan will address visibility protection as an objective and will address management actions (i.e. stop lighting, rapid mop up, public notification) to be taken if these impacts are not avoided due to changing atmospheric conditions.

All of these provisions will be reviewed within one year of adoption of this plan to:

- determine their effectiveness toward improving visibility
- document the actual impact on burners' ability to meet their debris-management objectives
- allow time to review newly published studies related to silvicultural burning and their impact on Class I areas (National Park Service, "Prevent Study")
- allow additional time for industrial burners to develop management strategies for alternative methods of debris disposal

SMOKE MANAGEMENT PLAN EXCEPTIONS

The smoke management plan cannot anticipate or provide for every possible scenario related to prescribed fire. Occasionally, situations arise or landowners make proposals that the smoke management plan does not address. The exception process provides a framework to review these proposals in a timely manner, and approve or disapprove them based on their merit. Proposals that do not conform to the smoke management plan may be approved if the proposal will provide the same or better protection of public health, safety and welfare (such as Class I area visibility) to that provided in the plan.

How to Apply for an Exception

If a landowner has a proposal that does not conform to the smoke management plan, the landowner may request an exception to the smoke management plan by providing DNR, in writing:

A description of the proposal;

A statement describing how the proposal does not conform to the smoke management plan;

A description of how the proposal provides the same or better protection of public health, safety **and welfare (such as Class I area visibility)** to that provided by the plan.

The DNR and DOE will review the proposal in a timely manner. The time line for the review will consider needs of the proponent. If both agencies concur, the proposal will be allowed subject to all other requirements of the smoke management plan.

DNR will notify the landowner of the decision.

Potential use of the Exception

For example, if it has been an exceptionally wet spring, a landowner may request to conduct forest health burns during the summer weekend visibility protection period.

The exception process is not an appeal process for disapproval of burns. The process cannot be used to avoid procedural requirements like smoke management approval, or emissions inventory requirements.

REQUIREMENTS FOR EMISSION REDUCTION

Two of the primary goals of this plan are to protect public health and promote the enjoyment of the natural attractions of the state. Reduction of emissions produced from burning, coupled with the use of alternative methods of debris disposal, will meet these goals by improving general air quality.

Fire is a historic, necessary, and natural part of the environment. There are conflicting public benefits when limiting the use of fire as a land management tool to protect air quality. When people move into areas where wildfires historically occurred, it becomes even more important to use prescribed fire to manage fire hazards and provide for the protection of human life and property, as well as forest health.

An example of this conflict is beginning to be seen in eastern Washington, where the need to use prescribed fire is increasing to reduce very high fuel loads. These high fuel loads have resulted from drought, insect and disease infestations and from the exclusion of fire from large areas through decades of fire suppression activities. Failure to manage this fuel loading increases the risk of a catastrophic wildfire.

The Legislature acknowledges the natural role of fire in forest ecosystems and finds it to be in the public interest to use fire under controlled conditions to prevent wild fires by maintaining healthy forests and eliminating sources of fuel.

This plan seeks to promote the efficient and wise use of fire, given the limited emission levels mandated by the legislature.

Directive: Emissions from burning covered by this plan must be reduced by 20 percent from baseline levels by December 31, 1994. This reduced level would provide a ceiling for emissions until December 31, 2000.

Emissions from burning covered by this plan must be reduced by 50 percent from baseline levels by December 31, 2000. This reduced level would provide a ceiling for emissions after that.

Emissions from silvicultural burning that is conducted in eastern Washington for the purpose of restoring forest health or preventing the additional deterioration of forest health are exempt from these ceilings.

If emission targets for December 31, 1994, are not met, the DNR will immediately limit burning not for forest health purposes to meet the 1994 target levels and ensure that burning in subsequent years will achieve equal annual incremental reductions to reach the December 31, 2000, reduction target level. If the emission reductions are met in 1994, but are not met by December 31, 2000, the

Department must immediately limit burning not for forest health purposes to reduce emissions to the December 31, 2000, target level in all subsequent years. (If necessary, this will be done by implementing the mandatory allocation system.)

EMISSION REDUCTION THRESHOLDS

The following are three possible scenarios, any one of which would demonstrate satisfactory achievement of mandatory emissions reduction levels:

SCENARIO #1

The total emissions produced in calendar year 1994 are equal to, or less than,
80 percent of the baseline emission level,

and then

the total emissions produced in calendar year 2000 are equal to, or less than,
50 percent of the baseline emission level,

and then

the total emissions produced each calendar year after that do not exceed 50 percent of the baseline emission level.

SCENARIO #2

The total emissions produced in calendar year 1994 are greater than 80 percent of the baseline emission level,

but

the mandatory emissions allocation system is activated and total annual emissions are reduced in equal annual increments so that the total emissions produced in calendar year 2000 are equal to, or less than, 50 percent of the baseline emission level,

and

total emissions produced each calendar year thereafter do not exceed 50 percent of the baseline emission level.

SCENARIO #3

The total emissions produced in calendar year 1994 are equal to, or less than,
80 percent of the baseline emission level,

but

the total emissions produced in calendar year 2000 is greater than 50 percent of the baseline emissions level,

and then

the mandatory emissions allocation system is activated and emissions are reduced to 50 percent of the baseline emissions level each calendar year after that.

CREATING THE EMISSIONS BASELINE

The calculation of the emissions baseline is a central feature of this plan because it provides the gauge by which success can be measured. The actual calculation of the emissions baseline is based on the final version of SMS-INFO developed by the USFS, Pacific Northwest Research Station, Seattle Forestry Lab in Seattle (PNW) in the Spring/Summer of 1993. The resulting emissions baseline will be published as an appendix to this plan as soon as it has been calculated. (A detailed explanation of the alternative baseline calculation methods considered is in Appendix 12.)

The baseline reflects historical levels of emissions from current participants of this plan only. Emissions data from past participants who are no longer included in this plan has been removed from the baseline calculations. Similarly, any Indian nations that choose to participate in the emissions reduction portion of this plan, and any other agencies not previously participating, will have their historical levels of emissions added to the baseline calculation and the total emissions baseline will be adjusted accordingly. All plan participants must supply available burning data to the DNR related to their management area for the baseline period.

The baseline determination method incorporates new fuels consumption and emissions research, computer modeling, and existing data from past burning. Where data from past burning have not been gathered, subjective estimates are made using a scientifically based statistical sampling from research. The backbone of the baseline determination method is the use of computer models created by the USFS, Pacific Northwest Research Station, Seattle Forestry Lab in Seattle (PNW), the basic field data gathered by those researchers over the past

10 years, and data supplied by burners during the baseline period. (Appendix 10 contains a more detailed description of the models used.)

"SMS - INFO"

The modeling system used to generate the baseline numbers and to calculate and track future emissions is called SMS-INFO. It was created by the U.S. Forest Service, Pacific Northwest Research Station, specifically at the request of Oregon Department of Forestry and Washington Department of Natural Resources to assist in the administration of their respective smoke management programs. This system reflects the best available science to predict the amount of emissions from broadcast burns, underburns, and pile burns. (See Appendix 10 for an overview of SMS-INFO.)

The types of emissions calculated by SMS-INFO include total particulate material (PM), particulate material 2.5 microns or less (PM-2.5), particulate material 10 microns or less in size (PM-10), carbon monoxide, methane, total non-methane hydrocarbons, and carbon dioxide**.**

PM-10 Emissions Baseline

This plan will use PM-10 emissions to measure compliance with mandated emission reductions levels.

The total emission baseline level will be the sum of broadcast/underburn emissions, greater than 100-ton pile emissions, and under 100-ton pile burn emissions.

The baseline will not be altered, except to reflect additions or subtractions of plan participants, or to incorporate improvements within SMS-INFO resulting from new research. Any such alteration will be described in the annual Smoke Management Report for that year.

EMISSIONS CALCULATION AND TRACKING SYSTEM

The Clean Air of Washington Act requires a tracking system to measure progress toward the emission reduction targets.

This tracking system includes: mandatory reporting of completed burns, a summary of emissions created by each plan participant, calculation of pre-burn and post-burn emissions, and the annual total of emissions produced compared to the targets to determine whether there is a need to implement the mandatory emission allocation system (page 17).

"Rule burning" and prescribed natural fires will not be reported or tracked by the plan's tracking system. (See Scope of the Plan, page 3.)

Data Reporting

Directive: All participants in the Washington Smoke Management Plan must report their burning activities to the DNR according to the procedures listed in Appendix 2 of this plan.

Reporting is not required for the following types of burning:

- State and private lands where the burning does not require a written permit ("rule burns")
- federal lands where burning is related to recreation (e.g., campfires) or is a single pile less than 10 feet in diameter, and
- other outdoor burning not covered by this plan, such as agricultural burning or burning in improved areas.

The DNR will be responsible for receiving and storing all burning data, and will be the official source from which data will be distributed to other interested parties**.**

Gross Fuel Loading Estimates

Directive: The gross fuel loading of material to be burned must be estimated using approved methods listed in Appendix 3.

The responsibility for estimating the gross fuel loading on each burn site rests with the individual federal Land Manager, tribal designee, or the DNR on lands it protects.

Emissions Calculation

The tracking system will use SMS-INFO and gathered field data to calculate and record the post-burn tonnage consumed and emissions created from the completed burning. This will include broadcast burning, underburning, and pile burning. The DNR will generate the official

emissions values to be used in the administration of this plan.

MANDATORY EMISSIONS ALLOCATION SYSTEM

The apportionment of burn approvals *may* become necessary if the emission reduction requirements of the Washington Clean Air Act are not met. The following mandatory system will provide an equitable and understandable method for apportioning emissions if it becomes necessary to activate it.

Responsibilities

The ***Supervisor*** will approve any deviation from this allocation plan and will notify the affected burner groups of the amount and duration of such deviation.

The Department's ***Resource Protection Division Manager*** is responsible for determining when the allocation system will be activated, and for coordinating or transferring surplus emission allotments (if any) between burner groups or between DNR Regions. The Resource Protection Division will continuously monitor emission production and periodically inform the managers of each burner group of their cumulative total emission production and trends.

Once the allocation system is activated, the following managers are responsible for prioritizing and limiting which burning will be approved on lands within their jurisdiction to avoid exceeding their emissions allotment: the ***Region Manager*** of each DNR Region; the ***Regional Forester*** of the USFS, Region 6; the ***Regional Director*** of the National Park Service, Pacific Northwest Region; the ***Base Commander*** of Fort Lewis or other military base where regulated burning occurs; the ***Associate Director*** for Oregon, Washington, and Idaho of the U.S. Fish and Wildlife Service, Region 1; the ***District Manager*** of the Spokane District Office of the U.S. Bureau of Land Management; and the ***tribal designee*** of participating Indian nations.

Activation

Activation of the mandatory allocation system will occur only if emission reduction thresholds (see scenarios, pp. 13-14) are not met.

The Resource Protection Division will develop trend curves that describe the most recent five-year average annual burning pattern of each manager and monitor trends as burning progresses throughout a calendar year.

If burning activity appears to be deviating significantly from the most recent five-year trend, the Resource Protection Division will notify each manager. If the total burning remaining to be done will cause the emissions ceiling to be exceeded, the DNR will activate the mandatory emissions allocation system.

The Resource Protection Division will notify each manager directly, and the public through news releases, that the mandatory allocation system has been activated, and inform the managers of the amount of emissions they may produce during the remainder of that calendar year. The managers must then prioritize their burning so that their allocation will not be exceeded.

Directive: All managers must immediately curtail all burning in their management area when the mandatory allocation system has been activated and they are notified that their emissions allocation has been exhausted.

The allocation system will remain in effect until Resource Protection Division determines that emissions will not exceed the statewide ceiling, and notifies the managers in writing of its cancellation.

Distribution

Emission allocations will be made based upon the percentage of average annual emissions produced by each manager during the previous five calendar years. The emission allocation will be adjusted annually to reflect the most current five-year period. No manager group will be precluded from burning because of an absence of historical burning data. Their current burning will be recorded and become the basis for future allocations.

Individual managers may petition Resource Protection Division for additional allocation. Such a petition should include a description of the burning to be done and a justification for deviating from the allocation system. The Resource Protection Division Manager will query the other managers for any surplus emissions that may be available. If none are available and the requesting manager wishes to pursue the request, it will be forwarded to the Supervisor for approval or denial. If approved, the remaining allocation for the other managers will be reduced proportional to their percentage of total emissions produced.

Nothing in this allocation system guarantees an emissions level to an individual manager. The Supervisor of the Department has the authority to make adjustments.

EMISSION REDUCTION TECHNIQUES

To maximize the effective use of fire within the emission levels allowed, it is necessary to employ improved burning techniques. The science of predicting the amount of emissions has improved within the last few years thanks to research done by the USFS Pacific Northwest Research Station. Computer models allow burners to analyze proposed burns and prepare burning prescriptions that will produce minimum emissions on each acre to be treated. Various site factors and burning technique scenarios can be tested in the models, and estimates of emissions that each scenario would produce can be calculated. This capability will allow burners to treat maximum acreage with minimum emission production.

When they become available, the DNR, in conjunction with the USFS, will distribute (at cost) copies of these models to burners who want them, and will provide, or arrange for, training in their operation.

Besides total emission reduction, it is an objective of this plan to reduce the amount of visible smoke produced in and around residential areas. The DNR encourages burners to use techniques, such as fans, crane piling, mass ignition, accelerated mop-up, and other methods of increasing combustion efficiency and reducing the smoldering stage of burning. Burning permits will require such practices in areas close to homes or other occupied structures not the property of the person doing the burning. The DNR will provide information about new burning techniques and equipment as this information becomes available.

ALTERNATIVES TO BURNING

Given the amount of acreage to be treated and the limited emission levels allowed, it is no longer possible to rely solely on burning to achieve silvicultural objectives and hazard abatement. Using alternatives to burning has become not only desirable, but also necessary to meet the expectations of the legislature. Therefore, alternative methods should always be investigated before choosing to burn.

DNR Region Managers must consider the availability and feasibility of burning alternatives during the permit issuance and burn approval process when selecting burns for approval after the mandatory allocation system has been activated,

where there is likelihood that burning in or near residential areas will cause a nuisance,

when alternatives are available, reasonably economical, and

when the use of the alternative will not cause other unacceptable environmental or human health effects.

As part of its obligation to encourage alternatives to burning, the DNR will

- gather and distribute information about burning alternatives through participation in interagency and industrial professional organizations and other appropriate forums. Various alternatives are already in use. (See Appendix 14.)

- cooperate with alternative disposal industries by bringing together industrial landowners and disposal industries.

- consult with local government agencies to determine the availability and cost of legal dumping at approved sites.

It is important to note here that the DNR's role in the area of burning alternatives is to facilitate technology transfer, not to initiate new research.

PUBLIC EDUCATION

Public education regarding burning regulations and emission reduction techniques is essential to the plan's success. The primary focus of this education effort will be small landowners and the general public.

DNR field representatives will be the center of this effort through daily contact with the public and small landowners while writing burning permits. They will provide written information about the rules and regulations, provide on-site training sessions about safe and efficient burning techniques, and answer questions.

Region office staff will answer general inquiries or direct those questions to field staff for follow-up action. They will also initiate contacts with local news media to generate feature stories about the burning program and burning regulations. The Regions will also include appropriate information about burning in displays used at public gatherings, such as fairs.

The ***DNR*** will provide press releases and public service announcements when needed, and distribute them to all media outlets within Washington State. It will also coordinate with other agencies' public affairs offices to combine information about burning when appropriate.

The ***Resource Protection Division*** will develop brochures and other printed materials to be used by the Region offices. It will also seek sponsors willing to distribute information materials supplied to them by the DNR, such as billing stuffers, grocery store handouts.

The ***DNR*** will also provide training about the provisions of this plan to private industrial landowners, if requested, through their professional organizations and trade groups.

Additional public education activities will be developed as an ongoing part of this plan.

BURNING PERMITS

Burning permits, either written or "by rule," are required by Washington State law (see Appendix 15) for burning on lands protected by the DNR. Failure to obtain or abide by the terms of an applicable permit is a violation. These requirements apply to all state and privately-owned lands in Washington that pay, or are subject to paying, Forest Protection Assessment.

Federal agencies are not required to obtain a permit; however, those agencies must abide by state and local air pollution control regulations.

Burning permits are issued and enforced by DNR Region staff or by other agencies that have contracted with the DNR to act on its behalf. The operational details of the burning permit program are in Appendix 4.

FEES

The Washington Clean Air Act requires the DNR to collect fees to pay for the costs of its air quality program, and to distribute those costs equitably among all sources whose emissions cause air pollution. Fees must be set by the DNR using required administrative procedures after consultation with the Forest Fire Advisory Board and the public. Fees are deposited in the Air Pollution Control Account administered by the State Treasurer. The legislature
appropriates funds to the DNR to cover the costs of administration and enforcement of the program.

The federal Clean Air Act requires all federal agencies that cause air pollution to comply with all state and local regulations and to pay fees to help defray the cost of those programs in the same manner and to the same extent as non-federal entities.

A method was developed, in consultation with the Forest Fire Advisory Board, that equitably distributes the DNR's air quality program costs among the various burner groups (see Appendix 13). The fee amounts reflect the best estimates of total program costs. Fees will be adjusted as necessary to reflect actual program costs. (The Forest Fire Advisory Board did not endorse the fee amount, only the method.)

The DNR will collect fees from state and private burners when validating written burning permits, and quarterly from federal burners through a billing process consistent with agency procedures. All fees are based upon the amount of emissions created as reflected by the number of tons of debris consumed. Fee amounts for federal agencies reflect their appropriate share of program costs, and are billed individually.

PLAN APPROVAL, REVIEW, AND UPDATING

This plan was reviewed by the public, participating agencies, forest landowners, and other interested parties before its adoption by the Supervisor of the Department of Natural Resources. Final plan adoption was announced in the news media, and by direct contact with the manager groups administering the plan.

All or portions of this plan may be further reviewed or updated as warranted. The Visibility Protection section will be reviewed within one year of adoption. A general review will occur within five years after initial adoption. The reviewers will include representatives of the original advisory committee and any others the DNR considers appropriate.

The original Smoke Management Plan advisory committee consisted of members from:

Department of Natural Resources
U.S. Forest Service
U.S. Park Service
Quinault Nation
Department of Ecology
County Fire Marshal
State Fire Chiefs' Association
Bureau of Indian Affairs
Fort Lewis
American Lung Association of Washington
Clean Air Coalition/Sierra Club
Local air pollution control agencies
Washington Forest Protection Association

The Resource Protection Division Manager will approve procedural changes that are *not* requirements of this plan, as necessary, and distribute those procedural changes to affected plan participants. Procedural changes that *are* requirements of this plan will be approved by the Resource Protection Division after consultation with the advisory committee.

General plan revisions will adopt the same review procedure as used for original adoption.

GLOSSARY

Agricultural Burning	The burning of vegetative debris from an agricultural operation necessary for disease or pest control, necessary for crop propagation and/or crop rotation, or where identified as the best management practice by the agricultural burning practices and research task force established in RCW 70.94.650 or other authoritative source on agricultural practices.
Air Pollution Episode	A period where a forecast, alert, warning, or emergency air pollution stage is declared, as stated in WAC 173-435.
Air Turbulence	Rapid fluctuations or changes in vertical motion of air over short distances.
Atmospheric Stability	The resistance of the atmosphere to vertical motion.
BLM	United States Department of Interior, Bureau of Land Management.
Broadcast Burning	Prescribed burning of debris on a designated unit of land, where the debris has not been piled or windrowed, by allowing fire to spread freely over the entire area.
Burn	A prescribed fire.
Class I Federal Areas	All international parks, national wilderness areas, and memorial parks larger than 5,000 acres, and all national parks larger than 6,000 acres (42 USC 7470).
DOD	United States Department of Defense.
DOE	State of Washington, Department of Ecology.
DNR	State of Washington, Department of Natural Resources.
Designated Areas	Critical areas designated by the Department of Ecology that are otherwise subject to air pollution from other sources. These currently are Port Angeles, Spokane, Grays Harbor, Raymond, and the I-5 corridor from Bellingham south to Vancouver.
Duff	The accumulation of partially decayed organic material found on the forest floor. Sometimes called a "humus" layer.
Escape	A condition which exists when a prescribed fire leaves the area where it was intended to remain.
Extreme Hazard	Particular hazardous forest fuel conditions as defined in WAC 332-24-650 and 332-24-652.
F&WS	United States Department of Interior, Fish and Wildlife Service.

Fire Dependent Ecosystem	Systems possessing organisms that require fire for their survival and continuance, with fire an essential part of the environment. The plant species that dominate are not only adapted to fire but possess fire-dependent structures, mechanisms, and functions. Where fire often serves as the driving source of life cycles.
Forest Land	Any unimproved lands that have enough trees, standing or down, to constitute in the judgment of the DNR, a fire menace to life or property. Sagebrush and grass areas east of the summit of the Cascade mountains may be considered forest lands when such areas are next to or intermingled with, areas supporting tree growth.
Impaired Air	A condition declared by the DOE or a local air pollution authority where meteorological conditions are conducive to an accumulation of air contamination with PM-10 and carbon monoxide at specified levels, and which threatens to exceed other limits established by DOE or an air authority.
Intrusion (Smoke Intrusion)	The intrusion of visible smoke into a designated area at an altitude less than 2,000 feet above ground level.
Inversion	A layer of air in which the temperature increases with height. The effect of various types of inversions is to greatly retard the dispersal of smoke.
LAN	A Local Area Network computer system.
Land Manager	The official responsible for ensuring that the requirements and operating procedures of this plan are met as they apply to burning on lands under their control: They include the DNR Region Manager, the Forest Supervisor for the USFS, the Park Superintendent for the NPS, the Refuge Manager for the F&WS, the District Manager for the BLM, and the Base Commander for the Military Base.
Landings	An area on a logging operation where logs that are taken from the forest are assembled, trimmed, limbed, and loaded for shipment.
Low Risk Areas	Remote areas where most pile burning represents little risk of causing smoke impacts to the public. Low risk areas have a higher threshold for burns requiring smoke management approval than other areas.
Mass Ignition	The rapid or simultaneous ignition of materials on a particular burn site.

Mixing Heights A term used to describe the potential for vertical mixing. It defines the height above the surface through which relatively vigorous mixing will take place in the vertical due to convection.

Mop-Up Action taken to completely extinguish a fire.

Multiple Day Burns A prescribed fire of any size that cannot be managed so that the smoke will be fully dispersed by 12:00 p.m. on the day after the first ignition of the burn area. Burns that the landowner chooses to ignite over several days, but could reasonably be burned in one day or managed on a day by day basis will not be considered multiple day burns. Large pile burns burned over a period of days are not multiple day burns because ignition can be stopped and the piles mopped up, if needed.

NFDRS National Fire Danger Rating System.

Non-Attainment Area A clearly delineated geographic area that has been designated by the Environmental Protection Agency and promulgated as exceeding a national ambient air quality standard or standards for one or more of the criteria pollutants, which includes carbon monoxide, fine particulate matter, sulfur dioxide, ozone, and nitrogen dioxide.

NPS United States Department of Interior, National Park Service.

Open Burning All forms of outdoor burning *except* agricultural and silvicultural burning. Further definition can be found in WAC 173-425-020.

Over-Flight of Smoke When a visible smoke column can be seen above a particular area, and is greater than 2,000 feet above ground level.

Pile Burning Burning material in piles as opposed to other configurations.

PM-10 Particulate material with an aerodynamic diameter of 10 microns or less.

Prescribed Burning Controlled application of fire to wildland fuels in either their natural or modified state under specific environmental conditions which allow the fire to be confined to a predetermined area, and at the same time to produce the fireline intensity and rate of spread required to attain planned management objectives.

Prescribed Natural Fire Fires ignited by natural means, i.e., lightning, which are permitted to burn under specific environmental conditions, in preplanned locations, with adequate fire management personnel and equipment available to achieve defined objectives. Prescribed natural fires are used for maintaining natural conditions and ecological processes in native ecosystems.

Range Lands Wildlands that do not meet the definition of forest lands.

Rule Burn	A specific type of small fire that doesn't require a written burning permit, but is subject to the rules listed in WAC 332-24-205 and WAC 332-24-211.
SIP	State Implementation Plan to meet the requirements and objectives of the United States Clean Air Act.
Sensitive Areas	Areas of heavy recreational use and population centers outside designated areas.
Silviculture	Management practices related to controlling, establishment, growth, composition, and quality of forest vegetation.
Silvicultural Burning	All burning on any land the DNR protects, or on any forest lands administered by federal agencies or Indian nations.
Smoke Dispersion	Those processes within the atmosphere which mix and transport smoke away from the source. This depends on three atmospheric characteristics: atmospheric stability, mixing height, and transport winds.
Suppression Forces	Persons and equipment necessary to contain a prescribed or wildfire.
Transport Winds	The wind speed and direction at the final height of smoke plume rise.
USFS	United States Department of Agriculture, Forest Service.
Underburning	Prescribed burning with low fire intensities under a timber canopy.
Unimproved Land	Land that is *not* cleared, pasture, or cultivated, that does *not* contain structures and accompanying yard, and that contains flammable material.
Visible Smoke	Smoke that is slightly visible but has a minimum impact on air quality or overall visibility.
WAC	Washington Administrative Code.
Wildfire	Any fire occurring on wildlands that is not meeting management objectives and thus requires a suppression response.

APPENDICES

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APPENDIX 1

Burn Submittal and Approval Procedures
Burns 100 Tons or Greater

Directive: The operating procedures listed in this appendix are requirements of this plan.

The following procedures apply to burning 100 tons of material or greater at a single burn site/permit site during a 24-hour period:

I. LANDS PROTECTED BY THE DEPARTMENT

A. Designated Regions are responsible for supplying the Smoke Management Meteorologist daily pilot balloon observations by 0700 hours during the burning season, as determined by Resource protection Division.

B. **Pre-Burn Reporting**
The Region is responsible for gathering and entering the pre-burn site data (see Appendix 2) into the smoke management reporting system prior to requesting authorization from the Smoke Management Section of Resource Protection Division.

C. **Afternoon Before the Burn**
The Region Manager is responsible for screening, pre-authorizing and prioritizing the burns submitted for the following day.

The Region submits a prioritized list of the next day's proposed burns via FAX or, when available, Resource Protection's Local Area Network (LAN) to the Smoke Management Section of Resource Protection Division the afternoon before the burn.

D. **Day of the Burn**
Smoke Management Section queries the FAX or, when available, LAN for all burns proposed for that day, by 0700 hours.

Smoke Management contacts the Region for update/clarification of burn site conditions at approximately 0800 hours if necessary.

Smoke Management verbally contacts Regions about which burns are authorized beginning at approximately 0800.
The Regions make the tentative approval decision, and begin to notify individual burners no later than 0830 hours.

Smoke Management Section posts a list of authorized burns for that day on the LAN by 1000 hours. Region Managers make the final decision about which burns receive final approval.

Regions may withhold final approvals for burning until site conditions are checked. This information is passed to the burn proponent via normal contact procedures. Burning is not allowed until final approval has been given and permit validation has been done.

E. **After The Burn**
Region gathers post-burn information (see Appendix 2) and transmits to Smoke Management within five business days after completion of the burn.

Smoke Management calculates actual tonnage consumed and notifies Region within three business days of receipt of the information from the Region.

II. FEDERAL AND PARTICIPATING TRIBAL LANDS

A. **Pre-Burn Reporting**
The Land Manager is responsible for gathering and entering the pre-burn site data (see Appendix 2) into the smoke management reporting system prior to requesting authorization from the Smoke Management Section of Resource Protection Division.

B. **Afternoon Before the Burn**
The Land Manager is responsible for pre-screening and prioritizing the burns submitted for the following day.

The Land Manager submits a prioritized list of the next day's proposed burns to the Smoke Management Section of Resource Protection Division via FAX, Resource Protection's Local Area Network (LAN) or SMS on the Forest Service communication system the afternoon before the burn.

C. **Day of the Burn**
Smoke Management gathers all burn requests for that day, by 0700 hours.

Smoke Management contacts the Land Manager about burns that are approved, beginning approximately at 0800 hours as soon as their office phone lines are open.

The Land Manager makes the final approval for burning and notifies their appropriate staff.

D. **After the Burn**
The Land Manager gathers post-burn information and transmits it to Smoke Management within five business days of burn completion, according to the procedure listed in Appendix 2.

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APPENDIX 2

Data Reporting Procedures

The Washington Clean Air Act requires that reductions to emissions from silvicultural burning must be made. To measure the reductions and to ensure that authorized emissions levels are not exceeded, data must be collected so that emissions can be calculated and recorded.

Directive: It is a requirement of this plan that the data described below and the timing and method for transferring that data be conducted according to the following procedures:

I. DATA COLLECTION REQUIRED

Data is required to be gathered for all burning for which a written permit has been issued by the DNR and all federal and tribal burning except:

- Prescribed Natural Fires
- Wildfires
- Recreation Fires and single piles less than 10' in diameter ignited in a 24-hour period as specified by agency/tribal rules.

II. DATA TRANSMISSION SYSTEM

The data transmission system has three allowable methods:

A. The DNR Local Area Network (LAN)

B. The USFS Smoke Management System (SMS)

C. Fax Machine

The DNR Regions will collect and enter the data for State and private burning and the US Forest Service will use the SMS on the federal Data General computer system. Other participants covered by this Smoke Management Plan will enter their data into one of the three systems to be determined by the DNR and the individual participant on a case-by-case basis.

A. **DNR LAN Data Transmission**

This system will collect two categories of data:

1. Small Burns (less than 100 tons)
2. Large Burns (100 tons and greater)

Each of the two burning categories above has data collected in the field on a form. The form for small burns is the burning permit itself, and for large burns is the burning permit plus attachment "A" on pages 5 through 7.

The completed form(s) are sent to the Region office and the data is entered into the LAN. Instructions to complete the electronic data entry will be given directly to the users through training.

B. **U.S. Forest Service - SMS Data Transmission**

Region 6 of the U.S. Forest Service developed and will maintain the Fortran-based SMS for its Data General computer system. The SMS allows input of data at Ranger District terminals, collection and editing of data by Forest Supervisors and forwarding to the DNR by an electronic mail system. The U.S. Forest Service data is combined with the DNR data within the Resource Protection LAN. Statewide data analysis is then accomplished with the SMS-INFO computer models and other report generators.

Region 6 maintains an Operators Manual for SMS. System problems/ questions and training will be resolved by the Region 6 staff.

C. **Fax Machine**

If this method is used data must be sent to DNR Resource Protection Division, Smoke Management Section, which is currently at fax # (360) 902-1781.

III. TIMELINESS OF DATA INPUT

Data must be entered within five business days of:

A. The date when the burning permit was validated for burns less than 100 tons on State and private lands, or

B. The date when the burning was completed for all other burns.

IV. DATA REQUIRED TO BE COLLECTED

A. **State and Private Burns Only**

The following data must be collected for all burns requiring a written burning permit from the DNR:

Permit Number
Region
District
County
Shutdown Zone
Fire District Number
Section
Township
Range
Legal Subdivision
Pile type
Landowner
Fee Amount Enclosed
Calculated Consumed Tons
Validation Date
Suspension Date (if any)

B. **All Burns**

The data included on "Attachment A" shown on pages 5 through 7 must be collected for State and private burns that will consume 100 tons and greater in a 24-hour period, and for all burning that requires reporting by other Land Managers.

Attachment A pre-burn data must be collected for all eastside burns qualifying for the forest health exemption.

V. DATA COLLECTION - TRANSITION (August 1, 1992 until notified)

A. For data transmitted via the U.S. Forest Service SMS system, all data will be entered by the Forest or Ranger District.

C. For data that will be transmitted via the DNR LAN:

1. A copy of each permit saved during a month will be forwarded to Resource Protection via regular mail the first business day of the next month unless otherwise directed. Include "Attachment A" when required.

2. For those State and private burns greater than 100 tons that have debit accounts and wish to use the post-burn data with the SMS-INFO model value for consumption and fee assessment, the Region will forward a copy of the completed "Attachment A" by FAX to Resource Protection Division. The data will be run in the model and the value of the consumption will be posted on the LAN with three business days.

3. Beginning in calendar year 1993, all required data will be entered into the LAN at the Region Offices or office of other federal/tribal Land Managers who have chosen the use of the LAN transmission method.

BURN PLAN (ATTACHMENT A) -- 100 Tons and Over

PRE-BURN DATA

ALL BURNS

Permit Number:

Region: ***(Circle One)*** **CES NES NWS SWS OLS SPS SES**

Burn Type: ***(Circle One)*** **B-Broadcast/Activity Fuels U-Underburn/Activity Fuels N-Underburn/Natural Fuels P-Pile/Landings Only**

Activity Fuels: Created as a result of human activity. Natural Fuels: Found "as is" in nature.

Type of Landowner: ***(Circle One)*** **A - Forest Service F - Other Federal S - State P - Private T - Tribal**

Township: _____ _____ _____ N Range: _____ _____ _____ E or W Section: _____ _____

Examples: T30N = 300N T6 1/4N = 062N T7 1/2N = 075N T6 3/4N = 067N

Elevation: _____ _____ _____ _____ Midslope and to nearest 500'

County: _____ _____ (See reverse side for county codes)

Property Owner's Name:
_____

Sale Name: _____ (Optional) Sale Number: _____ ***(Optional)***

Reason to Burn: ***(Circle One)*** **H - Hazard Reduction A - Abating an Existing Extreme Hazard**
W - Wildlife Habitat P - Preventing the Creation of an Extreme Hazard
S - Silviculture or Forest Health T - Training Exercise
R - Rare and Endangered Species E - Eastside Forest Health Exemption

Size of Unit: _____ Acres

If Broadcast/Underburn, use exact size of unit.
If Piles/Landings, use your best estimate of area from which the Piles/Landings were accumulated.

Predominant Species: ***(Circle One)***

D - Westside Douglas Fir/Hemlock/Cedar J - Eastside Juniper Stands
M - Eastside Mixed Conifer (Incl. Lodgepole Pine/Larch/Ponderosa Pine) B - Primarily Brush Fuels (E or W)
P - Eastside Stands that are 50 percent or more Ponderosa Pine G - Primarily Grass Fuels (E or W)
H - Westside Hardwood Stands

PILE BURNS -- (Plus the "Landing Portion" of Broadcast/Underburns)

Pile Tons: _____ Enter the total tons of Piles/Landings that will be burned.

Landing Tons: _____ Enter 00000 if no Piles or Landings will be burned.

Pile Calculation Method: *(Circle One)* O - Ocular (Eye) Estimate A - Aerial Photograph Interpretation

S - Statistical Sample of Piles

The method used to determined piled fuel loadings (i.e., How did you do it?).

Pile Type: *(Circle One)* H- Hand Piles T - Tractor/Dozer/Machine Piles G - Grapple/Crane/Shovel Piles

BROADCAST AND UNDERBURNS ONLY	**Diameter of Fuel in Inches**	**Tons/Acre (To the Nearest Whole Ton)**
	0 - 1/4"	
	1/4" - 1"	**___ ___ 2**
Loading Method: *(Circle One)* (How did you determine the Broadcast/Underburn fuel loading?)	**1" - 3"**	
	3" - 9"	
	9" - 20"	
	20" and Greater	

P1 - PNW51 (DNR Westside - Photo Series) T - Transect

P2 - PNW52 (DNR Eastside - Photo Series) M - Other Method (Incl. other Photo Series - Requires Fire Control Approval)

Fuel Loadings in Tons Per Acre:

Duff Depth: _____ _____

The average Duff Depth across the whole unit in inches and tenths of an inch. On-scene observation is an important measurement, however. If Duff Depth cannot be reasonably determined, leave entry blank.

Slope: _____ _____ _____ Average percent slope of unit.

Cut Date: _____ _____ _____ _____ *(Form is "MMYY")* Month and Year unit was cut. If natural fuels (not harvested), enter "9999." If unit harvested over an extended period of time, enter date when the unit was 70 percent cut.

M M Y Y

Snow Off Date: _____ _____ *(Form is "MM")* Month snow melted off unit. If never covered with snow last winter, enter "00."

Ignition Method: *(Circle One)* A - Airplane/Helo C - Combination of Air/Hand H - Hand O - Other

"How will the Broadcast burn be lighted?"

WASHINGTON COUNTIES

01 Adams	**21 Franklin**	**41 Lewis**	**61 Snohomish**
03 Asotin	**23 Garfield**	**43 Lincoln**	**63 Spokane**
05 Benton	**25 Grant**	**45 Mason**	**65 Stevens**
07 Chelan	**27 Grays Harbor**	**47 Okanogan**	**69 Thurston**
09 Clallam	**29 Island**	**49 Pacific**	**69 Wahkiakum**
11 Clark	**31 Jefferson**	**51 Pend Oreille**	**71 Walla Walla**
13 Columbia	**33 King**	**53 Pierce**	**73 Whatcom**
15 Cowlitz	**35 Kitsap**	**55 San Juan**	**75 Whitman**
17 Douglas	**37 Kittitas**	**57 Skagit**	**77 Yakima**
19 Ferry	**39 Klickitat**	**59 Skamania**	

POST-BURN DATA

ALL BURNS -- For all burns (Pile, Broadcast, Underburns, etc.)

Date Burned: _____ _____ _____ _____ _____ _____
M M D D Y Y

Ignition Time: _____ _____ _____ _____ Use 24-hour clock (1 PM = 1300, etc.)
H H M M

Actual Acres Burned: _____

Use your best estimate. If Piles/Landings, estimate the acres from which the burned Piles/Landings were accumulated.

PILE BURNS -- (Plus the "Landing Portion" of Broadcast/Underburns)

Consumed Pile Tons: _____ _____ _____ (Use the percent of pre-burn estimated tonnage actually consumed - in tons)

Consumed Landing Tons: _____ _____ _____ (Use the percent of pre-burn estimated tonnage actually consumed - in tons)

BROADCAST/UNDERBURNS ONLY

Ignition Duration in Minutes: _____ _____ _____ (Time necessary to light the unit)

Weather Data: Weather Station Used: _____

If you get the weather data from one of the following:

RAWS - Enter Station Name **NWS Office - Enter Station Name**

Fire Weather Station - Enter Station Name **On-Site - Enter "Unit"**
(e.g., Region Office, Ranger District Office, etc.)

Days Since Rain: _____ _____

Enter the number of days since significant rainfall (i.e., 1/2 inch of rain westside or 1/4 inch rainfall eastside) occurred within a 48-hour period.

Wind Speed: _____ _____ Average surface wind speed at the time of ignition (mph)

Fuel Moistures: (At the time of ignition)

Ten Hour: _____ _____ **1000 Hour: _____ _____ (If unavailable during the "off season," leave blank: use NFDRS when available)**

1000 Hour Method: *(Circle One)* N - NFDR-TH A - ADJ-TH W - Weighed (Oven Dried)

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APPENDIX 3

Tonnage Estimation Procedures

ESTIMATING GROSS FUEL LOADING AND TONS OF FUEL CONSUMED IN PRESCRIBED BURNS APPROVED METHODS

Directive: It is a requirement of this plan that only the following approved methods be used to calculate gross fuel loading of debris to be burned and tons of fuel consumed.

BROADCAST BURNS - DETERMINING GROSS WOODY FUEL LOADING - PHOTO SERIES METHOD

There are several Pacific Northwest Research Station (PNW) Photo Series available for quantifying forest residues. The photo series provide a reasonable means for estimating the tons of fuel in a unit that may be consumed by a prescribed burn. These publications contain series of photographs displaying different forest residue loading levels by size class, for areas of like timber types and cutting practices.

The photo series that will be the standard used by the Washington State Smoke Management Plan are:

USDA Forest Service General Technical Report PNW 51, 1976. Photo Series for quantifying Forest Residues in Coastal Douglas Fir-Hemlock Type and the Coastal Douglas Fir-Hardwood Type.

USDA Forest Service General Technical Report PNW 52, 1976. Photo Series for Quantifying Forest Residues in Ponderosa Pine Type, Ponderosa Pine and Associated Species Type, and Lodgepole Pine Type.

USDA Forest Service General Technical Report PNW-GTR-258, 1990. Stereo Photo Series for Quantifying Forest Residues in the Douglas Fir-Hemlock Type of the Willamette National Forest.

USDA Forest Service General Technical Report PNW-GTR-231, 1989. Stereo Photo Series for Quantifying Forest Residues in Coastal Oregon Forests: Second-Growth Douglas Fir-Western Hemlock Type, Western Hemlock-Sitka Spruce Type, and Red Alder Type.

Other photo series may be accepted for use if approved by the Department of Natural Resources, Resource Protection Division, Smoke Management Section.

Information with each photo includes measured weights, volumes and other residue data, information about the timber stand and harvest and thinning actions and fuel ratings. These photo series provide a fast and easy-to-use method for quantifying existing residues. This method, while not perfect, will provide reasonable estimates if used consistently. Experience in its use will increase the accuracy of estimates.[1] Procedures for use of the photo series to determine gross woody fuel loading are:

A. Observe each specific fuel size class of residue on the ground (for example, 3.1 to 9- inch loading).

B. Select a photo or photos that nearly match or bracket the observed fuel class.

C. Obtain the quantitative value for the characteristic being estimated from the data sheet accompanying the selected photo (or interpolate between photos).

D. These steps are repeated for each fuel size class or fuel characteristic needed.

The total gross woody fuel loading can then be calculated by summing the estimates.

[1] USDA Forest Service Pacific Northwest Research Station, General Technical Report, PNW-STR-258, Stereo Photo Series for Quantifying Forest Residues in the Douglas Fir-Hemlock Type of the Willamette National Forest, page 6.

An example of the above procedure using the PNW-GTR-258 Stereo Photo Series would be:

Fuel Class Size	Photo	Tons/Acre
0.00 - 0.25	**1-DFWH-PRE-16**	**2.5**
0.26 - 1.0	**1-DFWH-PRE-16**	**4.2**
1.1 - 3.0	**1-DFWH-PRE-13**	**5.9**
3.1 - 9.0	**1-DFWH-PRE-13**	**25.3**
9.1 - 20.0	**1-DFWH-PRE-13**	**2.0**
20+	**1-DFWH-PRE-12**	**0**
Total gross woody fuel load per/acre		**39.9**

If the general area being inventoried has areas with obvious differences in residue loading, the user should make separate determinations for each area and then weigh and cumulate the loading for the whole area.

Note: In addition to calculating the gross woody fuel load remaining on the logging unit, the field officer must add the net woody fuel load found on the landing areas that will be burned in that logging unit. Use the technique described below for "pile burning" to accomplish this task.

BROADCAST BURNS - DETERMINING GROSS WOODY FUEL LOADING - TRANSECT METHOD

A second approved method, the basis upon which the photo series was developed, is actual field sampling of proposed units.

The procedures for inventorying downed woody material are provided in two U.S. Forest Service technical reports published by the Inter-Mountain Forest and Range Experiment Station in Ogden, Utah. The "Handbook for Inventorying Downed Woody Material" by James K. Brown (USDA General Technical Report INT-16, 1974) and the "Graphic Aids for Field Calculation of Dead, Downed Forest Fuels" by Hal E. Anderson (USDA General Technical Report INT-45, August 1978) are the reference documents to be followed when doing a planar intersect sample.

PILE BURNING - DETERMINING GROSS FUEL LOADING

To determine tonnage in units that will be (but have not yet been) piled, the transect method or photo series method as described above can be used.
If units have already been piled, or for landings on units to be broadcast burned, one of the two following methods should be used:

A. Ocular Estimate of Pile Volumes

B. Statistical Sample of Pile Volumes

These methods are described in a publication from the Pacific Northwest Research Station, Fire and Environmental Research Applications, "Guidelines For Estimating Volumes, Biomass, and Smoke Production For Piled Slash," 1996, by Colin C. Hardy. The procedures for these two methods are:

OCULAR ESTIMATE OF PILE VOLUMES

Step 1**:** **Estimation of Piles:**
This system assumes half-spherical or paraboloid-shaped piles (see Shape Codes on page 9) and three-dimensional drawings beginning on page 9. Determine, through visual inspection, the average height, width, and number of piles on the area of consideration.

When appraising a unit, many piles will be irregularly shaped. Ocularly "smooth" the lobes, ridges, and valleys into an average, paraboloid or half-spherical shape. Long logs and poles extending beyond the average boundary surface of the pile can be accounted for by increasing the height an appropriate distance.

If a significant number of piles appear to exist in each of several average height or diameter classes, group them into appropriate classes noting average width, height, and number of piles for each class. It may be helpful to scale the piles' heights, relative to a 6-foot person.

Step 2: Calculate gross pile volume for the representative pile, piles, or groups of piles. The chart on page 18 will give total pile volume for a range of pile heights and widths.

Step 3: Calculate gross pile volume for total burn area:

Calculate the volume of piles on the total burn area by multiplying the number of piles by the average volume. If piles have been grouped into several size classes, calculate the total volume for each group, then sum the volumes.

Step 4: **Calculate Net Wood Pile Volume:**
Net wood volume of the piles must be estimated by reducing the total volume by a factor to account for the volume of air in the piles. To determine the net wood volume, multiply the total pile volume for the area by 0.1 for piles with species content dominated by ponderosa pine, multiply the total pile volume for the area by 0.2 for all other piles. The resulting value is the net wood volume.

Step 5: **Determine the Total Tons of Wood/Fuel on the Burn Area:**
If piles contain 25 percent or more of one wood species, determine the average species mix for the entire area. Calculate the average wood density on the basis of the species or mix of species present. The table below contains density weights for commonly found species in the Pacific Northwest. Multiply the proper net wood volume by the corresponding density factor from the table. Total these weights and divide by 2,000 pounds to convert to total tons.

Species	Specific Gravity (dimensionless)	Density (lb/ft)
Larch	**.48**	**30.0**
Douglas Fir	**.45**	**28.1**
Hemlock	**.42**	**26.2**
Pine	**.38**	**23.7**
Alder	**.37**	**23.1**
True Fir	**.37**	**23.1**
Red Cedar	**.31**	**19.4**
Sitka Spruce	**.37**	**23.1**
Rotten	**.30**	**18.7**

Example Unit:

Unit Description

Unit size is 30 acres of grapple piles
5 piles per acre, 150 total piles
Pile Shape: Half-sphere
Average pile height 8 feet
Species mix: 75 percent Douglas-fir, 25 percent Alder

Calculations

Gross pile volume (from chart on page 14) = 1,072 cubic feet
Net wood pile volume 0.20
1,072 cu.ft. x 0.20 (wood to pile ratio) = 214 cu.ft. per pile

Wood Weight

214 x 75 percent Douglas-Fir = 161 cu.ft. x 28.1 (Density) = 4,524.1
214 x 25 percent Alder = 54 cu.ft. x 23.1 (Density) = 1,247.4
Total net wood cubic feet per pile = 5,71
Total tons per pile 5,771/2,000 = 2.89 tons per pile
Total woody tons for the unit 2.89 tons x 150 piles = 433.5 tons

STATISTICAL SAMPLE OF PILE VOLUMES

A statistical sample of the piles on a given area provides valuable information regarding the distribution of shapes, sizes, and species composition of the area. This information greatly improves the accuracy of volume estimates.

Even when measuring only a sample of piles, field measurements are time-consuming and tedious. A set of seven stylized "shape codes" are shown on page 9 and the mathematical formulas for each shape is found on pages 9 through 11. These formulas are helpful in determining the appropriate measurements to be made on a specific pile.

Step 1: Identify a randomly-chosen set of piles to be measured on a given area. The number of piles selected is dependent on the time available and on the level of accuracy desired. Roughly sketch and number the piles on a map of the area for later identification and location.

Step 2: Visit each pile and visually determine the most representative stylized shape from the seven "shape codes" or the sketches on pages 9 through 11. Illustrated on each "shape code" drawing are the dimensional measurements required by the respective geometric formula to calculate total volume.

Step 3: Measure each dimension required for the shape.

Step 4: Identify the primary species (by mass) of woody debris in the pile, identified species must account for 25 percent or more of the mass of the piles. If mixed species, note the percent of the primary species and the percent of one secondary species. This data will be used to determine the net mass of fuel in the pile.

Step 5: Calculate the gross volume for each pile using either the formulas found on pages 9 through 11, or the appropriate chart or nomograph on pages 18 through 20.

Step 6: Calculate an average volume from the sampled pile volumes and multiply by the total number of piles in the area.

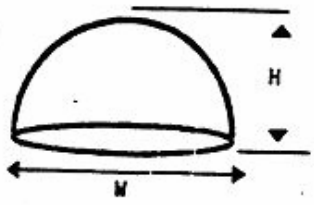
Step 7: Calculate Net Wood Pile Volume: Net <u>wood</u> volume of the piles must be estimated by reducing the total volume by a factor to account for the volume of air in the piles. To determine the net wood volume, multiply the total pile volume for the area by 0.1 for piles with species content dominated by ponderosa pine, multiply the total pile volume for the area by 0.2 for all other piles. The resulting value is the net wood volume.

Step 8: Determine the total tons of wood/fuel on the area of consideration.

Using the mix of species determined in step 4, calculate the average wood density on the basis of the species or mix of species. The table on page 5 contains density weight for commonly found species in the Pacific Northwest. Multiply the proper net wood volume by the corresponding density factor from the table to derive a pile-average density.

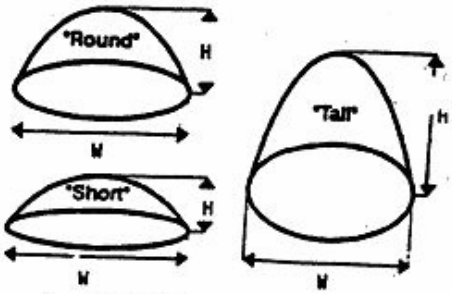
[The charts on pages 14 through 17 were created by DNR from Colin Hardy's formulas and can be used to determine consumable tons directly, for piles that are comprised of 76 percent or more of a single species.]

1. Half Section of Sphere



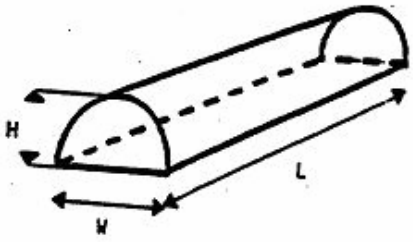
$V = .2618 * W * H$

2. Paraboloids



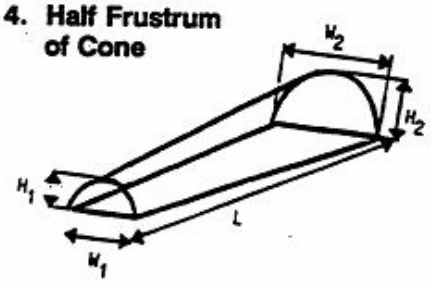
$V = .3927 * H * W$

3. Half Cylinder



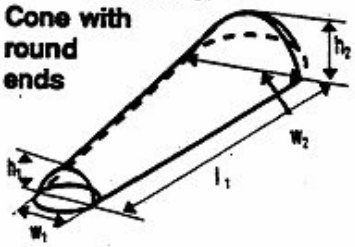
$V = .7854 * W * L * H$

4. Half Frustrum of Cone

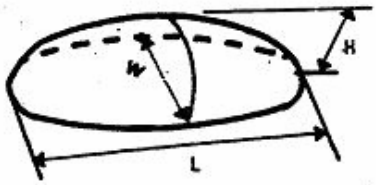


$V = .2618 * L(W_1H_1 + \sqrt{W_1H_1W_2H_2} + W_2H_2)$

5. Half Frustrum of Cone with round ends

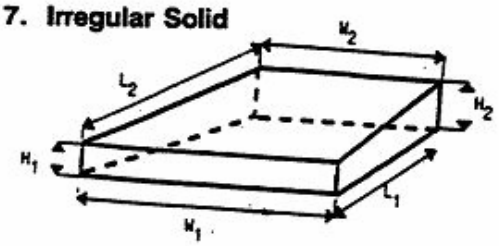


6. Half Ellipsoid



$V = .5236 * W * L * H$

7. Irregular Solid



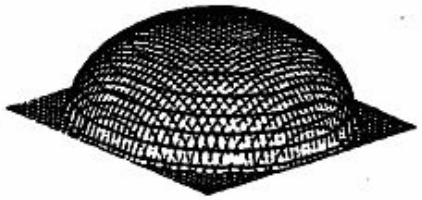
$$V = \frac{(L_1+L_2)*(W_1+W_2)*(H_1+H_2)}{8}$$

1. Half-Section of a Sphere:

Truly half of a ball, where the width is twice the height, and the sides are well and evenly rounded.

$V = \frac{2\pi H^3}{3}$ or $V = \frac{\pi HW^2}{6}$ or $V = .2618*W^3$

True Sphere Shape

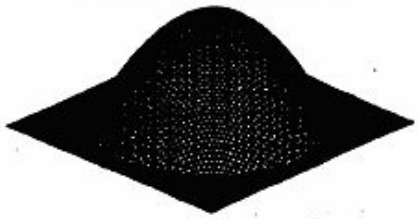


2a. Half-"Round" Paraboloid:

Pile height is same as radius (half diameter), but surface tapers in a parabola towards the top.

$V = \frac{\pi HW^2}{8}$ or $V = .3927*H*W^2$

"Round" Paraboloid Shape

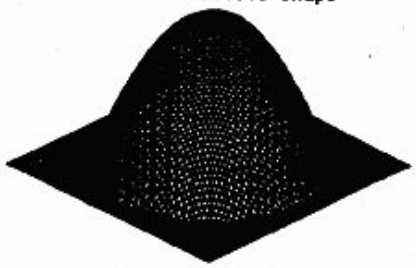


2b. Half-"Tall" Paraboloid:

Sides taper in a parabola towards the top, where the height is greater than the radius (half the width).

$V = \frac{\pi HW^2}{8}$ or $V = .3927*H*W^2$

"Tall" Paraboloid Shape



2c. Half-"Short" Paraboloid:

Pile height is less than half the radius, and the sides drop down to the base in a parabola.

$V = \frac{\pi HW^2}{8}$ or $V = .3927*H*W^2$

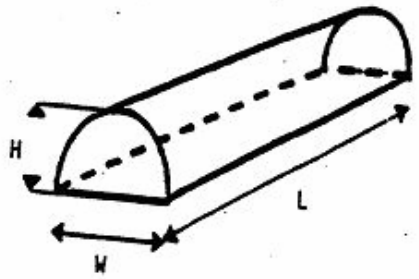
Flat Paraboloid Shape

3. Half Cylinder:

Logs and debris are generally aligned in parallel. Pile shape is rounded side-to-side, with both ends of the pile approximately the same height.

$$V = \frac{\pi WLH}{4} \quad \text{or} \quad V = .7854*W*L*H$$

Half Cylinder Shape



4. Half Frustum of Cone:

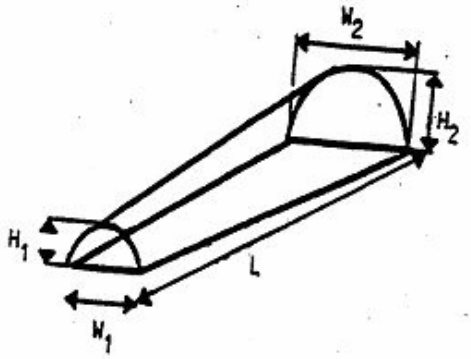
Logs and debris are generally aligned in parallel. Pile shape is rounded side-to-side, but heights of opposing ends are not equal (pile tapers).

$$V = \frac{\pi L(W_1H_1+(W_1H_1W_2H_2)^{.5}+W_2H_2)}{12}$$

or

$$V = .2618*L(W_1H_1+\sqrt{W_1H_1W_2H_2}+W_2H_2)$$

Half Frustum Cone Shape



5. Half Frustum of Cone (with Rounded Ends):

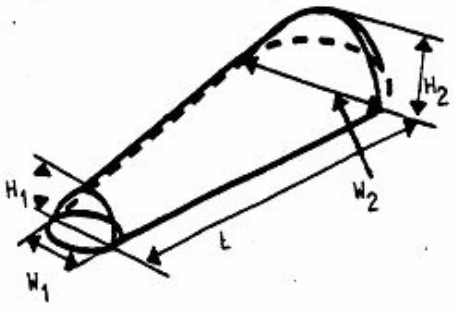
Pile shape is generally the same as #4, but the ends are rounded, and appearance is similar to half a pear.

$$V = \frac{\pi(LW_1H_1+L(W_1H_1W_2H_2)^{.5}+W_1^2H_1+LW_2H_2+W_2^2H_2)}{12}$$

or

$$V = .2618(LW_1H_1+L\sqrt{W_1H_1W_2H_2}+W_1^2H_1+LW_2H_2+W_2^2H_2)$$

Half Frustum Cone Shape
Rounded End

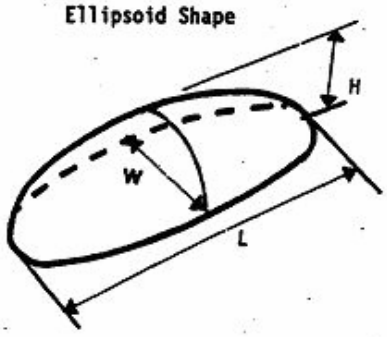


6. Half Ellipsoid:

Long, tapering pile, rounded side-to-side, with well-rounded ends. Widths of opposing ends are not equal.

$$V = \frac{\pi WLH}{6} \quad \text{or} \quad V = .5236*W*L*H$$

Ellipsoid Shape

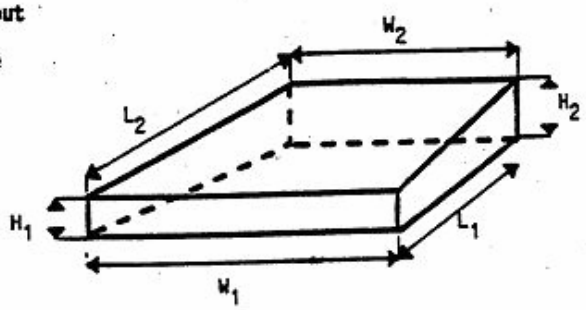


7. Irregular Solid:

Irregularly-shaped pile with straight but uneven sides. Dimensions for opposing sides are not necessarily equal. (Some landings).

$$V = \frac{(L_1+L_2)*(W_1+W_2)*(H_1+H_2)}{8}$$

Irregular Solid Shape



ESTIMATING CONSUMABLE TONS

Douglas fir	Paraboloid shaped piles													
	Height													
Dia	4	6	8	10	12	14	16	18	20	22	24	26	28	30
5	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.7
10	0.4	0.6	0.8	0.9	1.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0	3.0	3.0
15	0.8	1.0	2.0	2.0	3.0	3.0	3.0	4.0	4.0	5.0	5.0	5.0	6.0	6.0
20	2.0	2.0	3.0	4.0	5.0	5.0	6.0	7.0	8.0	8.0	9.0	10.0	11.0	11.0
25	2.0	4.0	5.0	6.0	7.0	8.0	9.0	11.0	12.0	13.0	14.0	15.0	16.0	18.0
30	3.0	5.0	7.0	8.0	10.0	12.0	14.0	15.0	17.0	19.0	20.0	22.0	24.0	25.0
35	5.0	7.0	9.0	11.0	14.0	16.0	18.0	21.0	23.0	25.0	28.0	30.0	32.0	34.0
40	6.0	9.0	12.0	15.0	18.0	21.0	24.0	27.0	30.0	33.0	36.0	39.0	42.0	45.0
45	8.0	11.0	15.0	19.0	23.0	27.0	30.0	34.0	38.0	42.0	46.0	49.0	53.0	57.0
50	9.0	14.0	19.0	23.0	28.0	33.0	38.0	42.0	47.0	52.0	56.0	61.0	66.0	70.0

Western hemlock	Paraboloid shaped piles													
	Height													
Dia	4	6	8	10	12	14	16	18	20	22	24	26	28	30
5	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.5	0.5	0.5	0.6
10	0.3	0.5	0.6	0.8	0.9	1.0	1.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0
15	0.7	1.0	1.0	2.0	2.0	2.0	3.0	3.0	3.0	4.0	4.0	5.0	5.0	5.0
20	1.0	2.0	2.0	3.0	4.0	4.0	5.0	6.0	6.0	7.0	7.0	8.0	9.0	9.0
25	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	13.0	14.0
30	3.0	4.0	6.0	7.0	8.0	10.0	11.0	12.0	14.0	15.0	17.0	18.0	19.0	21.0
35	4.0	6.0	8.0	9.0	11.0	13.0	15.0	17.0	19.0	21.0	23.0	25.0	26.0	28.0
40	5.0	7.0	10.0	12.0	15.0	17.0	20.0	22.0	25.0	27.0	30.0	32.0	35.0	37.0
45	6.0	9.0	12.0	16.0	19.0	22.0	25.0	28.0	31.0	34.0	37.0	41.0	44.0	47.0
50	8.0	12.0	15.0	19.0	23.0	27.0	31.0	35.0	39.0	42.0	46.0	50.0	54.0	58.0

ESTIMATING CONSUMABLE TONS

Red Alder	Paraboloid shaped piles													
	Height													
Dia	4	6	8	10	12	14	16	18	20	22	24	26	28	30
5	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.5	0.5	0.5	0.6
10	0.3	0.5	0.6	0.8	0.9	1.0	1.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0
15	0.7	1.0	1.0	2.0	2.0	2.0	3.0	3.0	3.0	4.0	4.0	5.0	5.0	5.0
20	1.0	2.0	2.0	3.0	4.0	4.0	5.0	6.0	6.0	7.0	7.0	8.0	9.0	9.0
25	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	13.0	14.0
30	3.0	4.0	6.0	7.0	8.0	10.0	11.0	12.0	14.0	15.0	17.0	18.0	19.0	21.0
35	4.0	6.0	8.0	9.0	11.0	13.0	15.0	17.0	19.0	21.0	23.0	25.0	26.0	28.0
40	5.0	7.0	10.0	12.0	15.0	17.0	20.0	22.0	25.0	27.0	30.0	32.0	35.0	37.0
45	6.0	9.0	12.0	16.0	19.0	22.0	25.0	28.0	31.0	34.0	37.0	41.0	44.0	47.0
50	8.0	12.0	15.0	19.0	23.0	27.0	31.0	35.0	39.0	42.0	46.0	50.0	54.0	58.0

Red Cedar	Paraboloid shaped piles													
	Height													
Dia	4	6	8	10	12	14	16	18	20	22	24	26	28	30
5	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.5
10	0.3	0.4	0.5	0.6	0.8	0.9	1.0	1.0	1.0	1.0	2.0	2.0	2.0	2.0
15	0.6	0.9	1.0	1.0	2.0	2.0	2.0	3.0	3.0	3.0	3.0	4.0	4.0	4.0
20	1.0	2.0	2.0	3.0	3.0	4.0	4.0	5.0	5.0	6.0	6.0	7.0	7.0	8.0
25	2.0	2.0	3.0	4.0	5.0	6.0	6.0	7.0	8.0	9.0	10.0	11.0	11.0	12.0
30	2.0	3.0	5.0	6.0	7.0	8.0	9.0	10.0	12.0	13.0	14.0	15.0	16.0	17.0
35	3.0	5.0	6.0	8.0	10.0	11.0	13.0	14.0	16.0	17.0	19.0	21.0	22.0	24.0
40	4.0	6.0	8.0	10.0	12.0	15.0	17.0	19.0	21.0	23.0	25.0	27.0	29.0	31.0
45	5.0	8.0	10.0	13.0	16.0	18.0	21.0	24.0	26.0	29.0	31.0	34.0	37.0	39.0
50	6.0	10.0	13.0	16.0	19.0	23.0	26.0	29.0	32.0	36.0	39.0	42.0	45.0	49.0

Sitka Spruce	Paraboloid shaped piles													
	Height													
Dia	4	6	8	10	12	14	16	18	20	22	24	26	28	30
5	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.5	0.5	0.5	0.6
10	0.3	0.5	0.6	0.8	0.9	1.0	1.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0
15	0.7	1.0	1.0	2.0	2.0	2.0	3.0	3.0	3.0	4.0	4.0	5.0	5.0	5.0
20	1.0	2.0	2.0	3.0	4.0	4.0	5.0	6.0	6.0	7.0	7.0	8.0	9.0	9.0
25	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	13.0	14.0
30	3.0	4.0	6.0	7.0	8.0	10.0	11.0	12.0	14.0	15.0	17.0	18.0	19.0	21.0
35	4.0	6.0	8.0	9.0	11.0	13.0	15.0	17.0	19.0	21.0	23.0	25.0	26.0	28.0
40	5.0	7.0	10.0	12.0	15.0	17.0	20.0	22.0	25.0	27.0	30.0	32.0	35.0	37.0
45	6.0	9.0	12.0	16.0	19.0	22.0	25.0	28.0	31.0	34.0	37.0	41.0	44.0	47.0
50	8.0	12.0	15.0	19.0	23.0	27.0	31.0	35.0	39.0	42.0	46.0	50.0	54.0	58.0

True Fir	Paraboloid shaped piles													
	Height													
Dia	4	6	8	10	12	14	16	18	20	22	24	26	28	30
5	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.5	0.5	0.5	0.6
10	0.3	0.5	0.6	0.8	0.9	1.0	1.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0
15	0.7	1.0	1.0	2.0	2.0	2.0	3.0	3.0	3.0	4.0	4.0	5.0	5.0	5.0
20	1.0	2.0	2.0	3.0	4.0	4.0	5.0	6.0	6.0	7.0	7.0	8.0	9.0	9.0
25	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	13.0	14.0
30	3.0	4.0	6.0	7.0	8.0	10.0	11.0	12.0	14.0	15.0	17.0	18.0	19.0	21.0
35	4.0	6.0	8.0	9.0	11.0	13.0	15.0	17.0	19.0	21.0	23.0	25.0	26.0	28.0
40	5.0	7.0	10.0	12.0	15.0	17.0	20.0	22.0	25.0	27.0	30.0	32.0	35.0	37.0
45	6.0	9.0	12.0	16.0	19.0	22.0	25.0	28.0	31.0	34.0	37.0	41.0	44.0	47.0
50	8.0	12.0	15.0	19.0	23.0	27.0	31.0	35.0	39.0	42.0	46.0	50.0	54.0	58.0

ESTIMATING CONSUMABLE TONS

Pine		Paraboloid shaped piles												
	Height													
Dia	4	6	8	10	12	14	16	18	20	22	24	26	28	30
5	0.0	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3
10	0.2	0.2	0.3	0.4	0.5	0.6	0.6	0.7	0.8	0.9	0.9	1.0	1.0	1.0
15	0.4	0.5	0.7	0.9	1.0	1.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0	3.0
20	0.6	0.9	1.0	2.0	2.0	2.0	3.0	3.0	3.0	3.0	4.0	4.0	4.0	5.0
25	1.0	1.0	2.0	2.0	3.0	3.0	4.0	4.0	5.0	5.0	6.0	6.0	7.0	7.0
30	1.0	2.0	3.0	4.0	4.0	5.0	6.0	6.0	7.0	8.0	9.0	9.0	10.0	11.0
35	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0
40	3.0	4.0	5.0	6.0	8.0	9.0	10.0	11.0	13.0	14.0	15.0	16.0	18.0	19.0
45	3.0	5.0	6.0	8.0	10.0	11.0	13.0	14.0	16.0	18.0	19.0	21.0	22.0	24.0
50	4.0	6.0	8.0	10.0	12.0	14.0	16.0	18.0	20.0	22.0	24.0	26.0	28.0	30.0

Larch		Paraboloid shaped piles												
	Height													
Dia	4	6	8	10	12	14	16	18	20	22	24	26	28	30
5	0.1	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.7	0.8
10	0.4	0.6	0.8	1.0	1.0	1.0	2.0	2.0	2.0	2.0	2.0	3.0	3.0	3.0
15	0.9	1.0	2.0	2.0	3.0	3.0	4.0	4.0	5.0	5.0	5.0	6.0	6.0	7.0
20	2.0	2.0	3.0	4.0	5.0	6.0	6.0	7.0	8.0	9.0	10.0	10.0	11.0	12.0
25	3.0	4.0	5.0	6.0	8.0	9.0	10.0	11.0	13.0	14.0	15.0	16.0	18.0	19.0
30	4.0	5.0	7.0	9.0	11.0	13.0	14.0	16.0	18.0	20.0	22.0	23.0	25.0	27.0
35	5.0	7.0	10.0	12.0	15.0	17.0	20.0	22.0	25.0	27.0	29.0	32.0	34.0	37.0
40	6.0	10.0	13.0	16.0	19.0	22.0	26.0	29.0	32.0	35.0	38.0	42.0	45.0	48.0
45	8.0	12.0	16.0	20.0	24.0	28.0	32.0	37.0	41.0	45.0	49.0	53.0	57.0	61.0
50	10.0	15.0	20.0	25.0	30.0	35.0	40.0	45.0	50.0	55.0	60.0	65.0	70.0	75.0

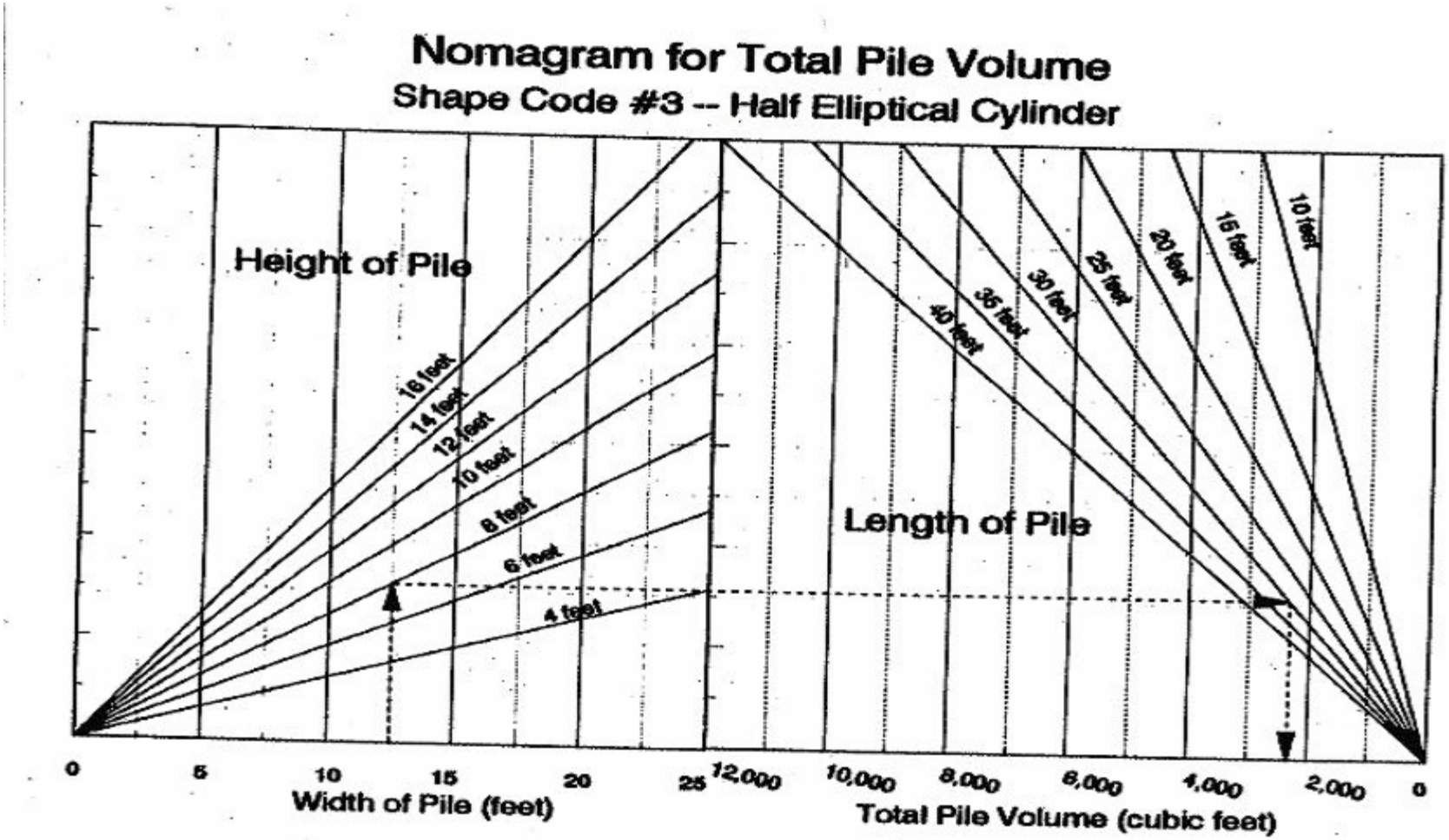
Spherical Piles

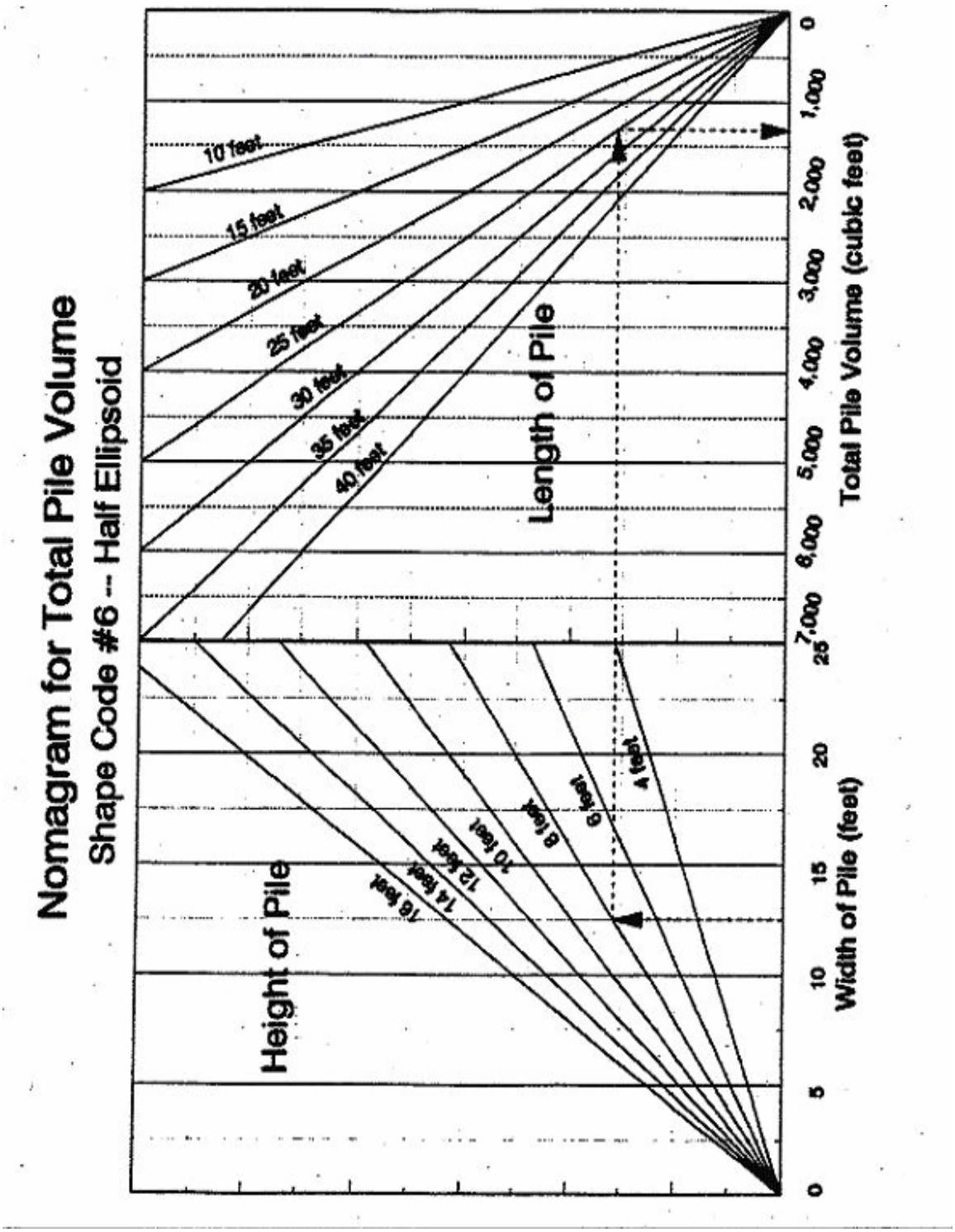
DO NOT USE if pile does not represent a spherical shape.

	Height													
	4	6	8	10	12	14	16	18	20	22	24	26	28	30
Species														
DF	0.3	1.0	3.0	5.0	9.0	14.0	20.0	29.0	40.0	53.0	69.0	88.0	110.0	135.0
WH	0.3	1.0	2.0	4.0	7.0	11.0	17.0	24.0	33.0	44.0	57.0	72.0	90.0	111.0
RA	0.3	1.0	2.0	4.0	7.0	11.0	17.0	24.0	33.0	44.0	57.0	72.0	90.0	111.0
SS	0.3	1.0	2.0	4.0	7.0	11.0	17.0	24.0	33.0	44.0	57.0	72.0	90.0	111.0
RC	0.2	1.0	2.0	3.0	6.0	9.0	14.0	20.0	28.0	37.0	48.0	61.0	76.0	93.0
T-Fir	0.3	1.0	2.0	4.0	7.0	11.0	17.0	24.0	33.0	44.0	57.0	72.0	90.0	111.0
Pine	0.1	0.5	1.0	2.0	4.0	6.0	9.0	12.0	17.0	22.0	29.0	37.0	46.0	57.0
Larch	0.3	1.0	3.0	5.0	9.0	15.0	22.0	31.0	43.0	57.0	74.0	94.0	117.0	144.0

Table of GROSS VOLUMES for piles with round bases (spheroids and paraboloids). If the pile surface is truly round (half of a ball), then refer to the column or row labeled "SPHERE." Use either height or width to determine volume. If pile surface tapers in a parabola, then determine the volume at the intersection of the appropriate width (rows) and height (columns).

If pile shape is "round" use SPHERE		SPHERE V V	If pile surface is "PARABOLOID" or "non-round" (flatter or taller than radius), use appropriate column-by-row Height of Pile > > > > 4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
SPHERE > > >		(w or h)	134	262	452	718	1072	1527	2094	2788	3619	4601	5747	7069	8579	10290	12215	14365	16755
Width	4	17	25	31	38	44	50	57	63	69	75	82	88	94	101	107	113	119	126
of Pile	5	33	39	49	59	69	79	88	98	108	118	128	137	147	157	167	177	187	196
V	6	57	57	71	85	99	113	127	141	156	170	184	198	212	226	240	254	269	283
V	7	90	77	96	115	135	154	173	192	212	231	250	269	289	308	327	346	366	385
V	8	134	101	126	151	176	201	226	251	276	302	327	352	377	402	427	452	478	503
V	9	191	127	159	191	223	254	286	318	350	382	414	445	477	509	541	573	604	636
V	10	262	157	196	236	275	314	353	393	432	471	511	550	589	628	668	707	746	785
V	11	348	190	238	285	333	380	428	475	523	570	618	665	713	760	808	855	903	950
V	12	452	226	283	339	396	452	509	565	622	679	735	792	848	905	961	1018	1074	1131
V	13	575	265	332	398	465	531	597	664	730	796	863	929	995	1062	1128	1195	1261	1327
V	14	718	308	385	462	539	616	693	770	847	924	1001	1078	1155	1232	1308	1385	1462	1539
V	15	884	353	442	530	619	707	795	884	972	1060	1149	1237	1325	1414	1502	1590	1679	1767
V	16	1072	402	503	603	704	804	905	1005	1106	1206	1307	1407	1508	1608	1709	1810	1910	2011
V	17	1286	454	567	681	794	908	1021	1135	1248	1362	1475	1589	1702	1816	1929	2043	2156	2270
V	18	1527	509	636	763	891	1018	1145	1272	1400	1527	1654	1781	1909	2036	2163	2290	2417	2545
V	19	1796	567	709	851	992	1134	1276	1418	1559	1701	1843	1985	2126	2268	2410	2552	2694	2835
V	20	2094	628	785	942	1100	1257	1414	1571	1728	1885	2042	2199	2356	2513	2670	2827	2985	3142
V	21	2425	693	866	1039	1212	1385	1559	1732	1905	2078	2251	2425	2598	2771	2944	3117	3290	3464
V	22	2788	760	950	1140	1330	1521	1711	1901	2091	2281	2471	2661	2851	3041	3231	3421	3611	3801
V	23	3185	831	1039	1246	1454	1662	1870	2077	2285	2493	2701	2908	3116	3324	3532	3739	3947	4155
V	24	3619	905	1131	1357	1583	1810	2036	2262	2488	2714	2941	3167	3393	3619	3845	4072	4298	4524
V	25	4091	982	1227	1473	1718	1963	2209	2454	2700	2945	3191	3436	3682	3927	4172	4418	4663	4909
V	26	4601	1062	1327	1593	1858	2124	2389	2655	2920	3186	3451	3717	3982	4247	4513	4778	5044	5309
V	27	5153	1145	1431	1718	2004	2290	2576	2863	3149	3435	3722	4008	4294	4580	4867	5153	5439	5726
V	28	5747	1232	1539	1847	2155	2463	2771	3079	3387	3695	4002	4310	4618	4926	5234	5542	5850	6158
V	29	6385	1321	1651	1982	2312	2642	2972	3303	3633	3963	4293	4624	4954	5284	5614	5945	6275	6605
V	30	7069	1414	1767	2121	2474	2827	3181	3534	3888	4241	4595	4948	5301	5655	6008	6362	6715	7069


Nomagram for Total Pile Volume
Shape Code #3 -- Half Elliptical Cylinder
Height of Pile
16 feet
14 feet
12 feet
10 feet
8 feet
6 feet
4 feet
Length of Pile
40 feet
35 feet
30 feet
25 feet
20 feet
15 feet
10 feet
0
5
10
15
20
25
Width of Pile (feet)
12,000
10,000
8,000
6,000
4,000
2,000
0
Total Pile Volume (cubic feet)


Nomagram for Total Pile Volume
Shape Code #6 -- Half Ellipsoid
Length of Pile
10 feet
15 feet
20 feet
25 feet
30 feet
35 feet
40 feet
Height of Pile
16 feet
14 feet
12 feet
10 feet
8 feet
6 feet
4 feet
Width of Pile (feet)
Total Pile Volume (cubic feet)
0
5
10
15
20
25
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000

CALCULATION OF TONS CONSUMED

FOR BROADCAST BURNING

The official method for calculating the amount of fuel consumed and resulting emissions will be by using the SMS-INFO computer model headquartered at Resource Protection Division, Smoke Management Section, and input provided by managers for each burn. A personal computer version of the "consume" model and an accompanying "Consume Users Guide" by Roger D. Ottmar, Mary M. Burns, Janet N. Hall, February 1993, that will allow individuals to calculate consumed tonnage to aid in planning is available through Resource Protection Division.

For purposes of determining a burning permit fee amount, a manual method of calculating consumption will be used along with several fixed variables assigned. Work sheets for that purpose are found beginning on page 34.

The same manual method of calculation can be used by burners for planning purposes by assigning actual variables. The procedure for manual calculation is:

Woody Fuel Consumption

The calculation of fuel consumed should utilize the graphs included in this document. The graphs were taken from the following resource materials: USFS research report, "Predicting Fuel Consumption by Fire Stages to reduce Smoke from Slash Fires," Roger D. Ottmar, and USDA, Forest Service Pacific Northwest Research Station, research report, "Improved Prediction of Fuel Consumption During Spring-Like Prescribed Burns," February, 1990.

Two options exist for estimating fuel consumption using nomographs. They represent summer-like burning conditions and spring-like burning conditions. Summer-like conditions are driven by 1000-hour fuel moisture and only calculate consumption of fuels greater than 3 inches. Fuels less than 3 inches are 100 percent consumed. Spring-like conditions are driven by 10-hour and 1000-hour fuel moisture calculating consumption of both 100-hour and 1000-hour fuels. Fuels less than 1 inch are 100 percent consumed.

To determine which set of nomographs to use determine the 10-hour fuel moisture of the unit to be burned. If the 10-hour fuel moisture is less than 18 percent then use the summer-like procedure. If the 10-hour fuel moisture is equal to or greater than 18 percent and the NFDRS 1000-hour fuel moisture is greater than 20 percent use the Spring-Like procedure.

SUMMER-LIKE PROCEDURE (Summer-Like Conditions)

Use the graph on page 29 to provide an estimate of the large (3+ inches) fuel consumption as a function of 1000-hour fuel moisture. Three alternatives are provided to determine the 1000-hour fuel moisture. It is strongly recommended that burners only use the NFDR-th hour fuel moisture or the moisture measured by weighing. Other methods are often done improperly and cause erroneous results. For fuels smaller than 3 inches, total consumption should be assumed when calculating the total woody fuel consumption. Use the procedures beginning on page 23 for calculating duff consumption.

SPRING-LIKE PROCEDURE (Spring-Like Conditions)

To determine if spring-like conditions exist for a unit to be burned, determine if average 10-hour fuel moistures are 18 percent or greater and the NFDR 1000-hour fuel moistures are greater than 20 percent. If NFDR 1000-hour fuel moisture are less than 20 percent, the calculation must use the summer-like condition. To check 10-hour fuel moisture take an average of 10 to 15 moisture meter measurements collected from across the unit in the .25-inch to 1-inch diameter fuels. The measurements should be taken from the full fuel profile and represent the different aspects that may exist.

For planning units to be burned, use the best available 10-hour fuel moisture information. Realize that accurate 10-hour fuel moistures are very critical for this system and are very site specific. When planning, the following recommendations can be used; establish representative 10-hour fuel sticks which can be conveniently weighed, track currently burned units, have personnel use moisture meters to measure 0.25 to 1 inch fuels when in the area. However, when the unit is burned on-site, actual measurements must be taken to calculate consumption to be entered into the smoke management reporting data.

Total tons consumed should be determined as follows:

A. For 1-hour and 10-hour fuels (less than 1 inch) assume 100 percent consumption.

B. For 100-hour fuels (1.0 inch to 3.0 inches) use the woody fuel consumption nomograph for 100-hour fuels, on page 27 to determine the percentage consumption (based on your measured 10-hour fuel moisture). Enter the 10-hour fuel moisture content figure on the x-axis and draw a vertical line to the curved line. Draw a horizontal line left across the graph from that point to determine the 100-hour fuel consumption in percent.

C. For 1000-hour fuels (3+ inches) use spring-like large woody fuel consumption nomograph, on page 28 to determine the 1000-hour fuel consumption, by size class, in percent.

D. Total all of the calculated per acre tonnages consumed (from steps A through C) and multiply by the unit acres. This is the total woody tons consumed.

(See example on next page.)

Example:

An example of the spring-like procedure using the tons/acre from the previous example on page 2, assuming a 10-hour fuel moisture of 20 percent, and NFDR-th fuel moisture of 29 percent and 30 acres would be:

Fuel Size Class	Tons/Acre	Estimated Percent Consumed	Tons/Acre Consumed
0.00 - 0.25"	**2.5**	**100**	**2.5**
0.26" - 1.0"	**4.2**	**100**	**4.2**
1.1" - 3.0"	**5.9**	**70**	**4.1**
3.1" - 9.0"	**25.3**	**29**	**7.3**
9.1" - 20.0"	**2.0**	**12**	**0.2**
20"+	**0**	**0**	**0**
Total	**39.9**		**18.3**

Total woody consumption for the unit 30 acres x 18.3 tons/acre + 549 tons consumed.

Then calculate duff consumption using the procedures described later.

Duff Consumption

In addition to calculating the woody fuel consumption, the duff consumption needs to be calculated on broadcast and underburns. Use the appropriate graphs on pages 30 through 33 to determine duff consumption; the graph you use depends on rainfall in the burn area. Instructions for using the graphs are as follows:

A. For westside units to be burned when there have been fewer than 25 days since a 0.5 inch or more of rain has fallen over a continuous two-day period (i.e., duff layer is moist):

   1. Use the consumption estimate (in tons/acre) of large (3+ inches) woody fuels previously calculated (see example above).

   2. Enter the large, woody fuel consumption value (tons/acre) on the x-axis of the graph on page 30 and draw a vertical line to the appropriate pre-burn duff depth. Turn left to determine duff consumption (tons/acre).

B. For westside units to be burned when there have been 25 or more days since at least 0.5 inches of rain has fallen over a continuous two-day period (i.e., duff layer is dry):

   1. Determine the diameter reduction inches of the large (3+ inches) woody fuels from the graph on page 28 or 29.

2. Enter the diameter reduction (inches) on the x-axis of the graph on page 31 and draw a vertical line to the appropriate pre-burn duff depth. Turn on the duff depth line and draw a horizontal line to the left to determine duff consumption (tons/acre).

C. For eastside units use the eastside graphs on pages 32 and 33. Using the procedures in steps 1 and 2 above, realize the critical precipitation value is 0.25 inches instead of 0.5 inches.

Note: Be sure to enter the correct variable on the correct graph based on rainfall information you are using.

The graphs on pages 27 through 33 were provided by the Pacific Northwest Research Station. The limitations of the duff consumption methodology are given in Ottmar's 1985 paper, "Predicting Duff Reduction to Reduce Smoke from Clearcut Slash Burns in Western Washington and Western Oregon."

Total Fuel Consumption

The total fuel consumption is the sum of the woody fuel consumption, both large and small fuel, and the duff consumption. The total (in tons/acre) should be multiplied by the number of acres that are being burned, or are expected to be burned, when planning units.

CALCULATION OF TONS CONSUMED FOR PILE BURNING

Pile Burning

For calculation purposes, assume that 85 percent of the net pile volume is consumed.

This assumption is validated by observations from pile consumption research and the acknowledgement of the variation of pile consumption in real life applications.

[The charts on pages 13 through 17 were created by DNR from Colin Hardy's formulas and the 85 percent consumption factor (above) to determine consumable tons directly. This only applies for piles that are comprised of 76 percent or more of a single species and are paraboloid or half-spherical shaped.**]**

PROCEDURE FOR USING LARGE FUEL CONSUMPTION NOMOGRAPHS FOR SPRING-LIKE AND SUMMER-LIKE PRESCRIBED BURNS

a. Determine percent consumption of the 100-hour fuels using the 100-hour fuel consumption nomograph. If 80 percent or less of the 100-hour fuels are predicted to consume (10-hour fuel moisture is 18 percent or greater), use the spring-like large fuel consumption nomograph. If greater than 80 percent of the 100-hour fuels are predicted to consume (10-hour fuel moisture content is less than 18 percent), use the summer-like large fuel consumption nomograph.

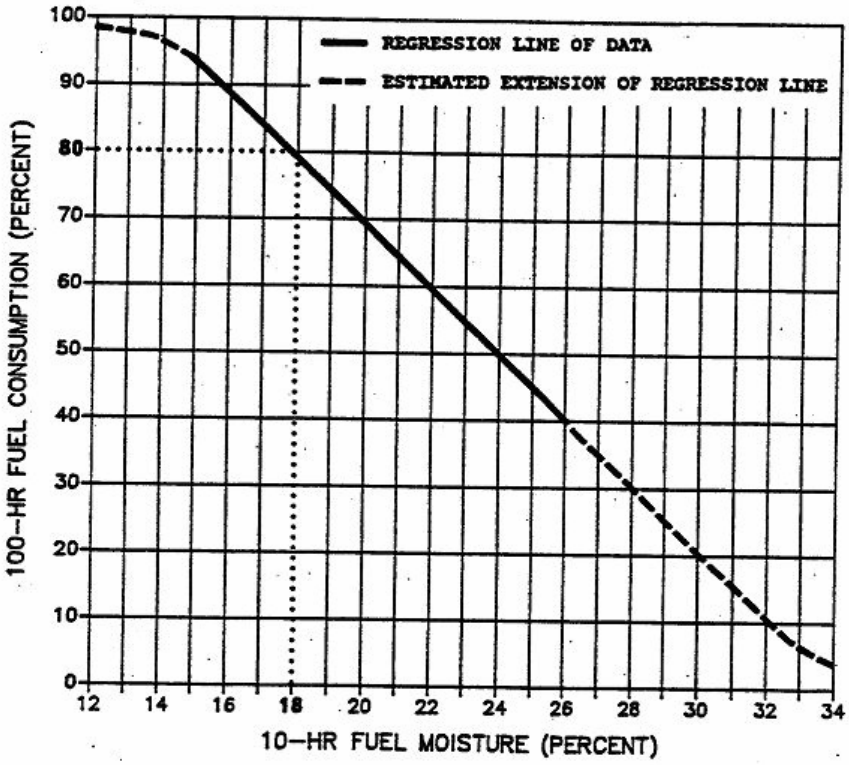
b. Determine the 1000-hour fuel moisture content (percent) for the unit determined from fuel moisture samples, National Fire Danger Rating System's 1000-hour fuel moisture model, or the Adjusted 1000-hour Fuel Moisture model.

c. Enter the 1000-hour fuel moisture (percent) on one of the fuel moisture bars corresponding to the procedure you used to determine the fuel moisture. Next, draw a vertical line to the appropriate fuel size class line. Draw a horizontal line left across the graph from that point to determine the percent consumption.

PROCEDURE FOR USING 100-HOUR FUEL CONSUMPTION NOMOGRAPHS

a. Determine an average 10-hour fuel moisture content for the unit. This can be accomplished by weighing 10-hour fuel sticks positioned in the unit or taking an average of 10 to 15 moisture meter measurements collected across the unit from 1/4 to 1-inch diameter fuels.

b. Enter the 10-hour fuel moisture content figure (percent) on the x-axis and draw a vertical line to the curved line. Draw a horizontal line left across the graph from that point to determine the 100-hour fuel consumption in percent.



Woody fuel consumption nomograph for 100-hour fuels. Dotted line represents cut-off for spring-like burn.

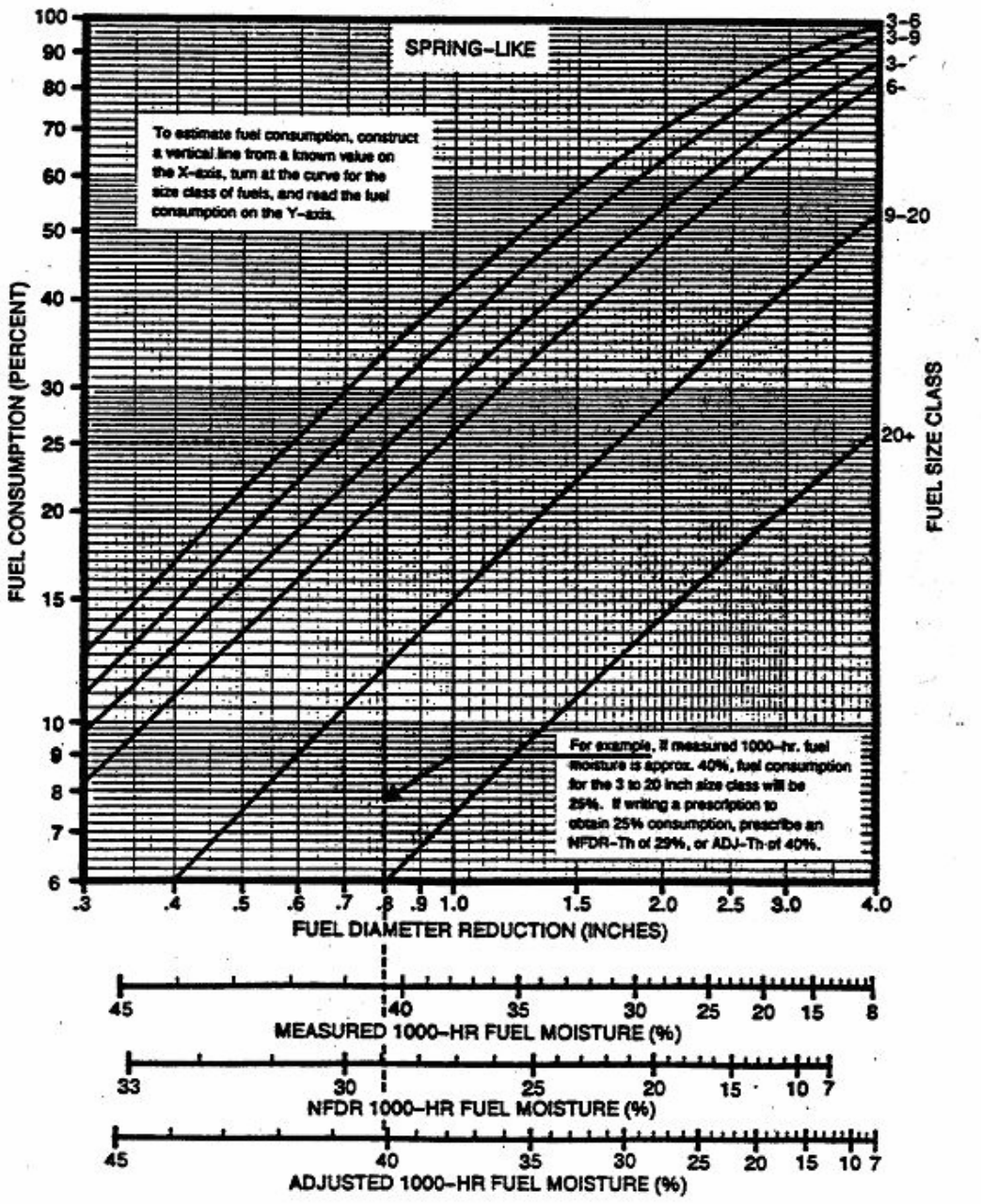


Figure 13. Large woody fuel consumption nomograph for spring-like burns.

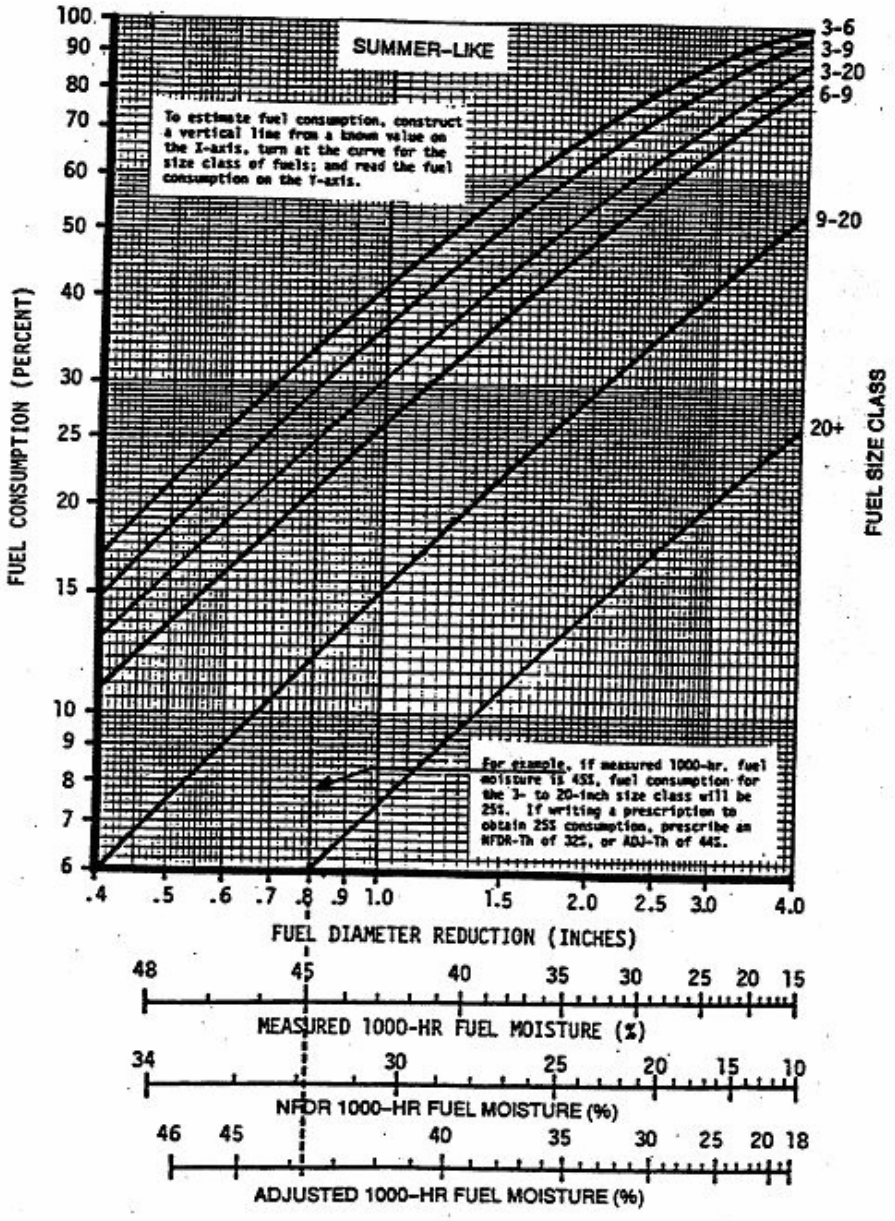
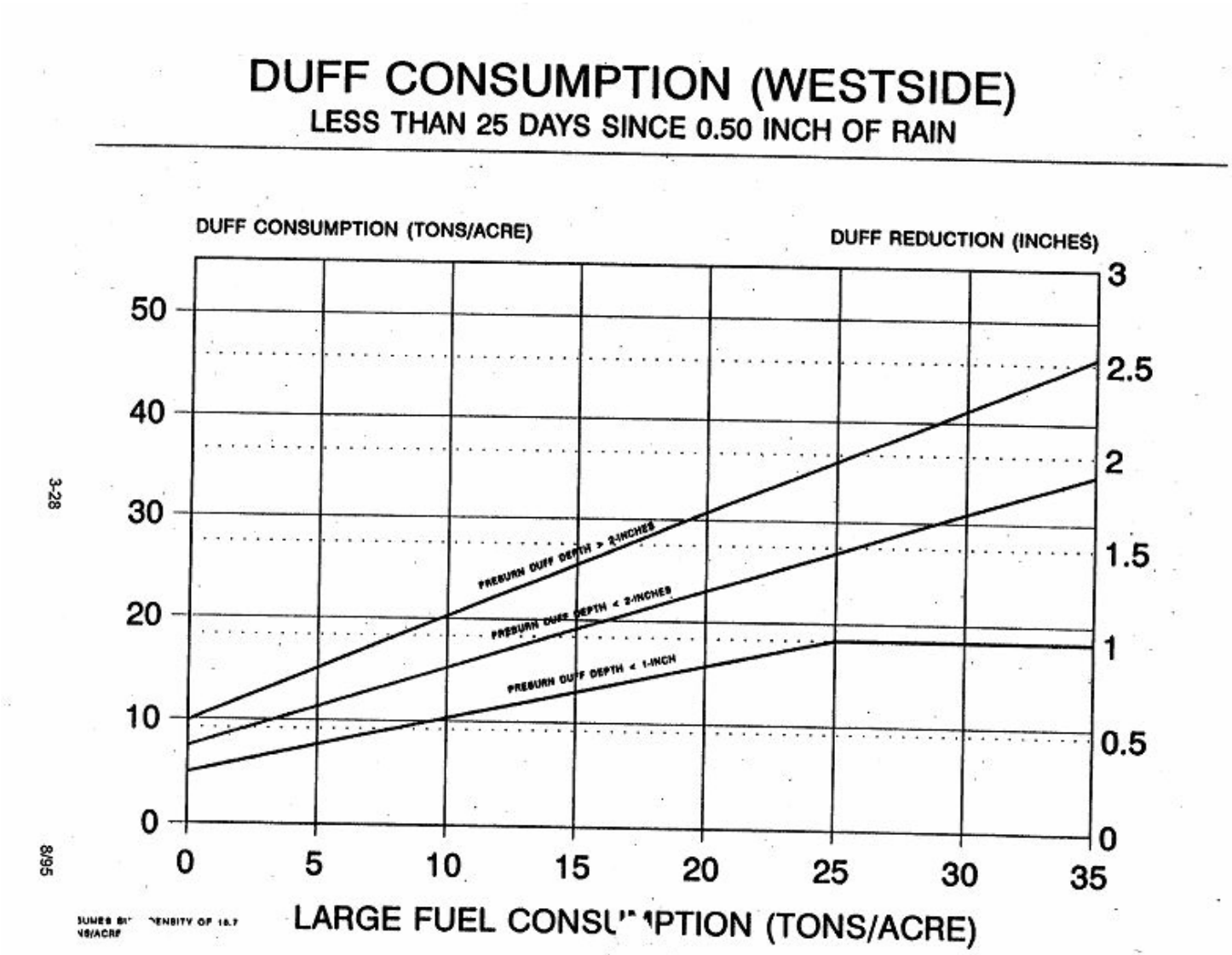
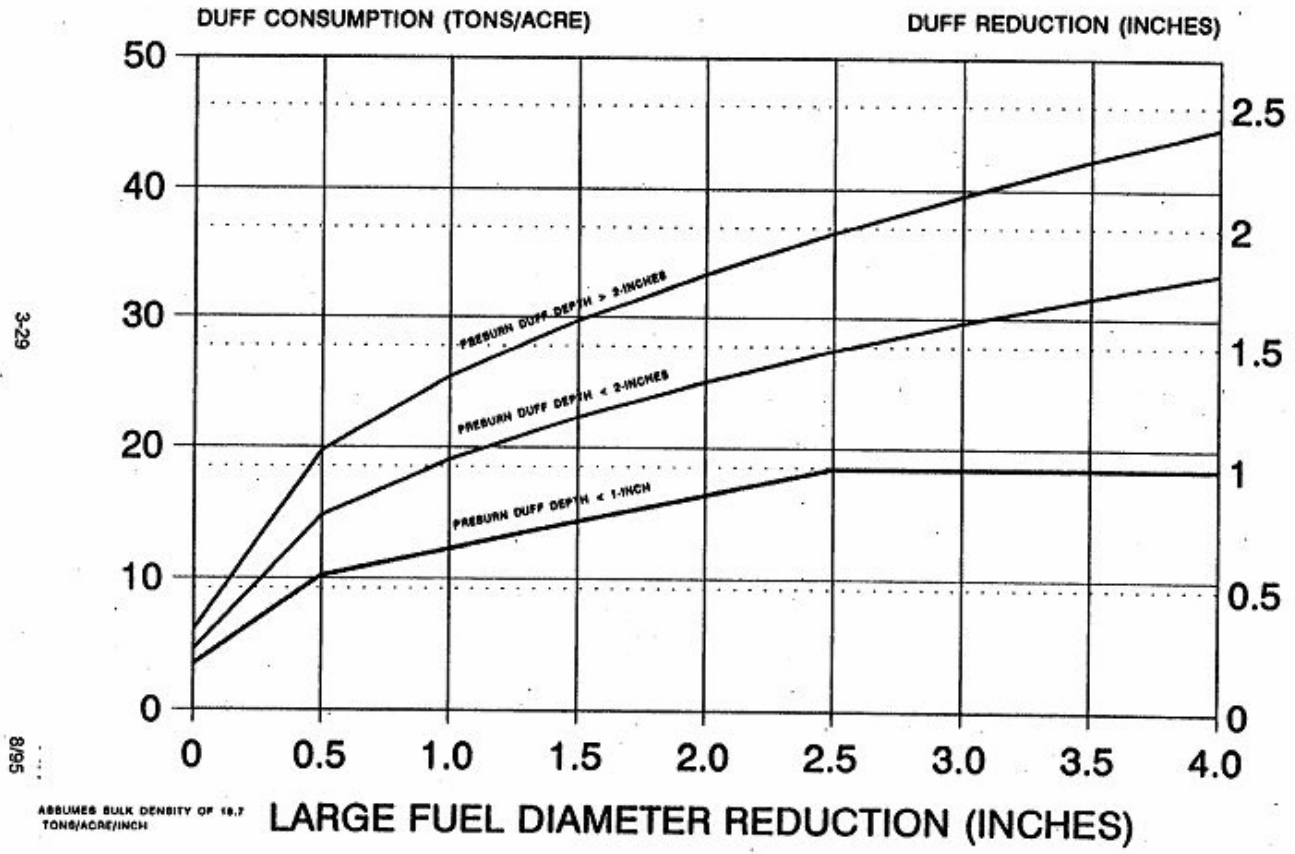


Figure 14. Large woody fuel consumption nomograph for summer-like burns.


DUFF CONSUMPTION (WESTSIDE)
LESS THAN 25 DAYS SINCE 0.50 INCH OF RAIN
DUFF CONSUMPTION (TONS/ACRE)
DUFF REDUCTION (INCHES)
50
40
30
20
10
0
3
2.5
2
1.5
1
0.5
0
PREBURN DUFF DEPTH > 2-INCHES
PREBURN DUFF DEPTH < 2-INCHES
PREBURN DUFF DEPTH < 1-INCH
0
5
10
15
20
25
30
35
LARGE FUEL CONSU PTION (TONS/ACRE)
3-28
8/95

DUFF CONSUMPTION (WESTSIDE)

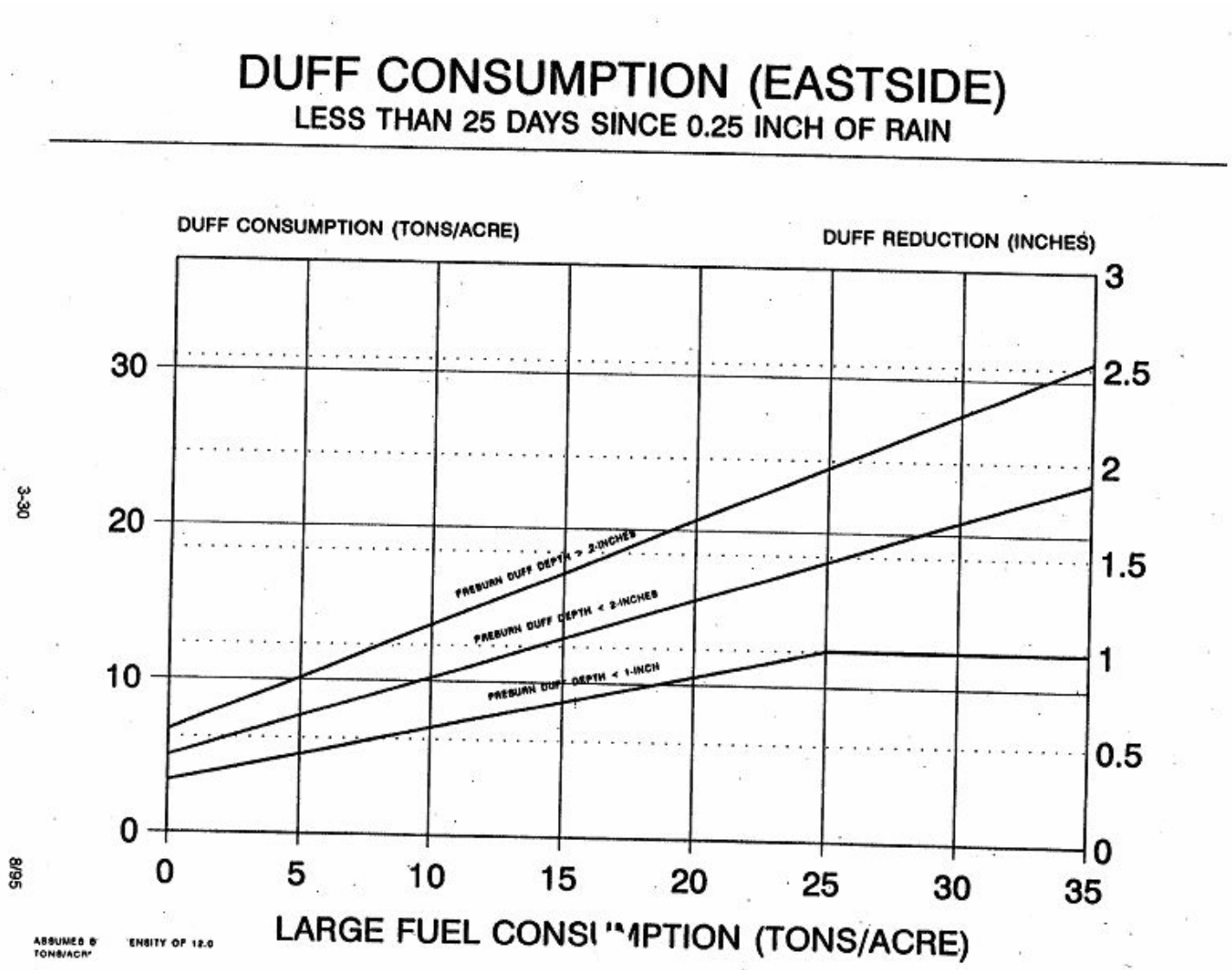
GREATER THAN 25 DAYS SINCE 0.50 INCH OF RAIN



3-29

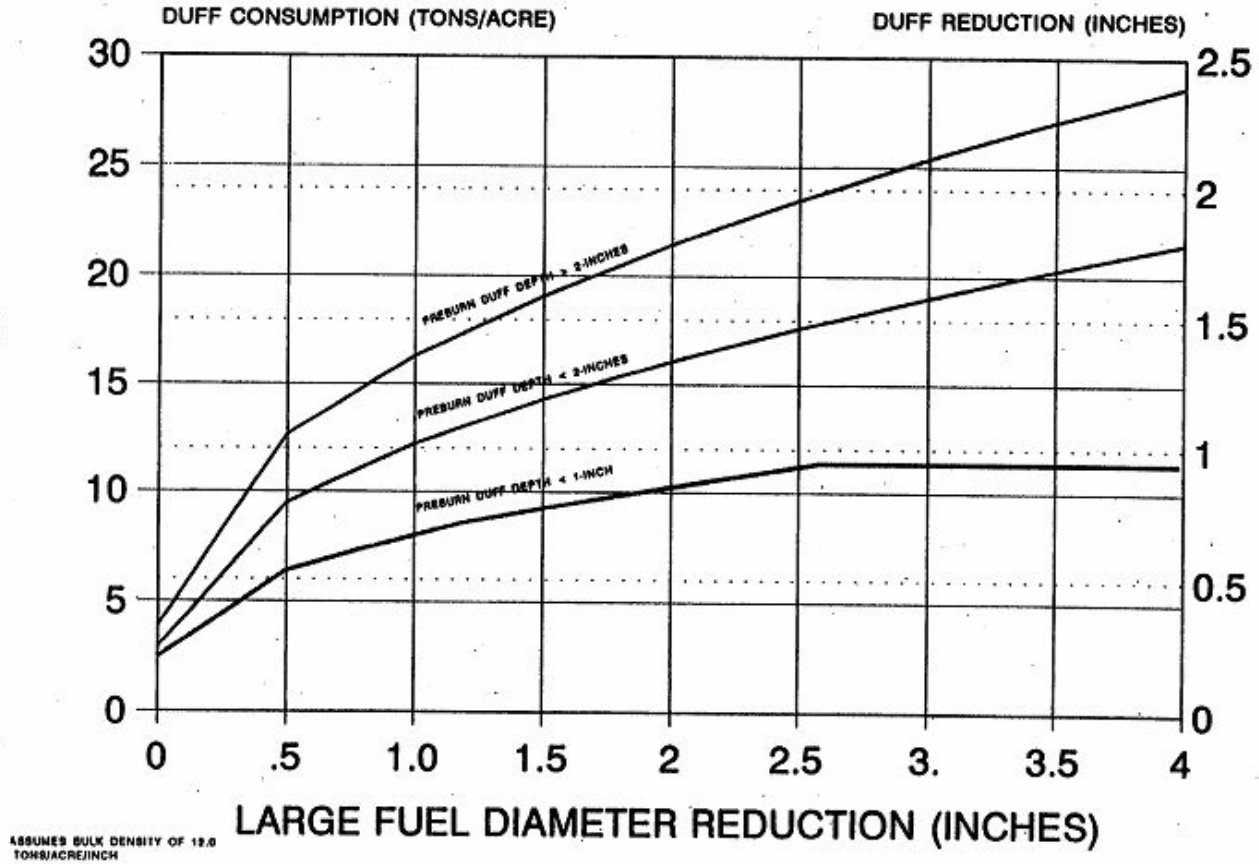
8/95

ASSUMES BULK DENSITY OF 16.7 TONS/ACRE/INCH


DUFF CONSUMPTION (EASTSIDE)
LESS THAN 25 DAYS SINCE 0.25 INCH OF RAIN
DUFF CONSUMPTION (TONS/ACRE)
DUFF REDUCTION (INCHES)
30
20
10
0
3
2.5
2
1.5
1
0.5
0
PREBURN DUFF DEPTH > 2-INCHES
PREBURN DUFF DEPTH < 2-INCHES
PREBURN DUFF DEPTH < 1-INCH
0
5
10
15
20
25
30
35
LARGE FUEL CONSUMPTION (TONS/ACRE)
3-30
8/95

DUFF CONSUMPTION (EASTSIDE)

GREATER THAN 25 DAYS SINCE 0.25 INCH OF RAIN



3-31

8/95

ASSUMES BULK DENSITY OF 12.0 TONS/ACRE/INCH

BROADCAST BURN UNIT CALCULATION SHEET

PHOTO NUMBER	TONS	SIZE CLASS	CONVERSION FACTOR EAST	CONVERSION FACTOR WEST	CONSUMABLE WOODY FUEL PER ACRE OVER 3"	CONSUMABLE WOODY FUEL PER ACRE TOTAL
		1/4 1	100%	100%		
		1+ 3	100%	80%		
		3+ 9	82%	39%		
		9+ 20	40%	16%		
		20+	20%	8%		
FUEL LOAD IN TONS/ACRE					OVER 3" (1)	TOTAL (2)

DUFF CONSUMPTION TABLE

TOTAL CONSUMABLE FUELS OVER 3" (From Figure 1 Above)	DUFF CONSUMED IN TONS/ACRE EASTSIDE	WESTSIDE
5 Tons/Acre	5	12
10 Tons/Acre	7	16
15 Tons/Acre	9	20
20 Tons/Acre	11	24
25 Tons/Acre	13	28
30 Tons/Acre	13	32
35 Tons/Acre	13	36

Enter Duff Tons/Acre (From Chart Above)	(3)
Enter Total Consumable (From Figure 2 Above) Woody Fuel in Tons/Acre	(4)
Total of Lines 3 and 4	(5)
Total Acres in Unit	(6)

TOTAL CONSUMABLE FUEL ON UNIT
(Figure 5 X Figure 6)

3-32

8/95

PILE BURN UNIT

STATISTICAL SAMPLE CALCULATION SHEET

Pile No. _____ (See Attached Map for Location)

Shape Code Used _____

Primary Species Wt/Ft^3 _____

Primary Species % _____

Secondary Species Wt/Ft^3 _____

Secondary Species % _____

Sketch Pile Shape and Required Dimensions

Formula Used: _____

Calculations

Gross Pile Vol. _____ X .20 = (Net Pile Volume) = 1 | |

Pri. Species % _____ X Wt/Ft^3 _____ = 2 | |

Sec. Species % _____ X Wt/Ft^3 _____ = 3 | |

$$\frac{\text{Fig. 1 X Fig. 2 + Fig. 1 X Fig. 3}}{2000} = \text{\_\_\_\_\_ Tons (Gross Pile Wt)}$$

Gross Pile Wt X .85 = _____ (Pile Consumable Tons)

3-33

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PILE BURN UNIT

STATISTICAL SAMPLE CALCULATION SHEET

Pile No. _____ (See Attached Map for Location)

Shape Code Used _____

Primary Species Wt/Ft^3 _____

Primary Species % _____

Secondary Species Wt/Ft^3 _____

Secondary Species % _____

Sketch Pile Shape and Required Dimensions

Formula Used: _____

Calculations

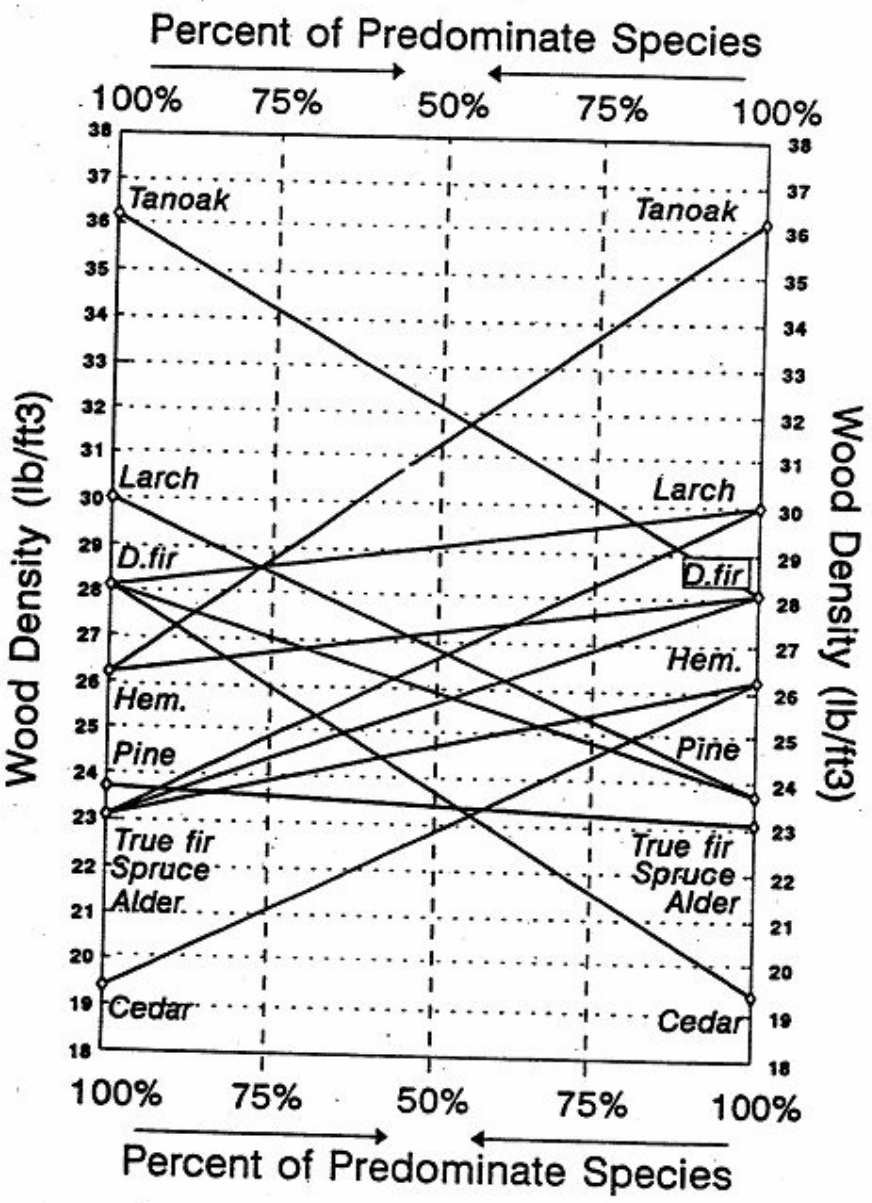
Gross Pile Vol. _____ X .20 = (Net Pile Volume) = 1 | |

Pri. Species % _____ X Wt/Ft^3 _____ = 2 | |

Sec. Species % _____ X Wt/Ft^3 _____ = 3 | |

$$\frac{\text{Fig. 1 X Fig. 2 + Fig. 1 X Fig. 3}}{2000} = \text{\_\_\_\_\_ Tons (Gross Pile Wt)}$$

Gross Pile Wt X .85 = _____ (Pile Consumable Tons)


Percent of Predominate Species
100%
75%
50%
75%
100%
Wood Density (lb/ft3)
38
37
36
35
34
33
32
31
30
29
28
27
26
25
24
23
22
21
20
19
18
Tanoak
Larch
D.fir
Hem.
Pine
True fir
Spruce
Alder
Cedar
Tanoak
Larch
D.fir
Hem.
Pine
True fir
Spruce
Alder
Cedar
Wood Density (lb/ft3)
100%
75%
50%
75%
100%
Percent of Predominate Species

Washington State Smoke Management Plan
1996

APPENDIX 3a

STATISTICAL SAMPLE METHOD FOR BURNS UNDER 100 TONS

Background

A critical component of the Smoke Management Program is an accurate emissions inventory. Data collected from previous years will be used to refine and improve data collection procedures and the quality of the emissions inventory. Analysis of the over 20,000 tonnage estimates collected on state and private burns between 1993 and 1995 reveal these facts:

Ninety percent of all burns are under 100-tons.
Burns under 100-tons account for about 40 percent of tonnage consumed.
The mean burn size is under thirty-tons.
The standard deviation of the mean tonnage is 26.2 tons.

This information provides the basis to determine the minimum sample size necessary to develop an emissions inventory accurate to within ± 4 percent. The strategy to accomplish this is to Sample all burns over 100-tons and enough burns under 100-tons to develop an estimate of total Tonnage consumed accurate to within ± 4 percent at a 90 percent level of confidence.

Statistical analysis of under 100 ton burn permits					
Year	Number of permits	Mean tonnage estimate	Standard deviation of mean	Required sample size	Required sample Percent
1995	6847	29.0	25.5	298	4.3%
1994	6090	29.8	26.2	297	4.9%
1993	6136	30.1	26.9	307	5.0%

Conclusion

A random sample of tonnage on five percent of all under 100-ton burn permits and Measurement of all over 100-ton permits will provide an acceptable estimate of emissions from silvicultural burning on a statewide basis.

Procedures

note: These Procedures are effective July 1, 1996.

The DNR field administrator will:

Measure tonnage on every twentieth permit (permit numbers ending in 00, 20, 40, 60, 80), and every permit more than 100-tons. All measurements will be taken carefully using only the methods approved in appendix 3 of the Smoke Management Plan.

Document calculations and measurements then submit the documentation to the region office with the burn permit.

The Region Office will:

Maintain documentation of tonnage calculation and measurements with the burning permit file.

Enter all permits into the burning permit database.

Resource Protection Division will:

Audit 20% of measured permits each quarter.

Washington State Smoke Management Plan
1993

APPENDIX 4

Burning Permit Issuance
State and Private Lands

The following procedures apply only where the Department, or other agencies contracted to act on behalf of the Department, issue written burning permits on Department-protected lands. These procedures may be modified at any time by the Resource Protection Division Manager.

I. GENERAL OPERATING INSTRUCTIONS

A. The permittee may pay the Region office in person or by mail. Field administrators may collect fees in the exact amount by check or money order payable to the Department of Natural Resources.

B. Once the Region office receives payment in the mail or delivered in person, there will be **NO REFUNDS**.

C. The fee schedule listed in WAC 332-24-221 will be used to determine the fee amount of each permit.

D. Burners are required to get burn-day approval before igniting their burns.

For burns that will consume less than 100 tons in a 24-hour period, burners must call "1-800-323-BURN" and follow instructions for the area and day of their proposed burn.

For burns that will consume 100 tons or greater in a 24-hour period, Smoke Management Plan burn submittal/approval procedures will be used.

Failure to follow the "call-in" instructions or "large burn" approval process will be a violation of the conditions of an approved permit and be subject to enforcement action.

E. Separate permits are required for each individual burn site. The single exception allows multiple "landings" to be burned by a single landowner, on that landowner's ownership located within an individual Township.

(Common sense will dictate variation from this directive.) Individual piles away from loading areas are not considered landings.

Separate permits will not be granted for portions of larger logged units that are planned to be burned and/or are likely to be burned because of escape within the permit period when, in the opinion of the field administrator, the purpose of such requests is to manipulate the permit fee structure. Permits must not overlap Region boundaries.

F. Burning permits will not be used to regulate mill burners. RCW 76.04.215 "Burning Mill Wood Waste" is to be used for that purpose.

G. If burning restrictions occur due to fire danger or smoke management concerns, burning permits will be suspended, not revoked or cancelled. No new permit will be required after the suspension is lifted, but no extension of time on the expiration date will be added. No new fees will be charged.

H. Region Managers will establish standards that will allow burning permit site visit reductions commensurate with staffing allocations. Region Managers will provide a written copy to Resource Protection Division.

Region criteria must achieve the following objectives:

1. Burning permits must allow for variable burning conditions and provide a reasonable assurance that escapes and/or smoke intrusions will not occur.

2. Emission calculations must be achieved by a reliable and statistically valid process. Fuel loading estimates must be made by "qualified" persons using estimation procedures approved in Appendix 3 of this Smoke Management Plan.

I. Prior to burning, Regions will audit 5 percent of the burn sites that did not receive a site inspection. Audit results should document tonnage, estimation accuracy, and suitability of permit conditions for the site. If tonnage determined from burner supplied information varies by greater than+/- 20 percent from the Region auditor's tonnage determination, the Region must take remedial action, i.e., determine training needs, review criteria, disqualify a "qualified" estimator after consultation with Resource Protection Division. The Regions will keep copies of audits for one year from the date that the activity took place.

J. All written permits must be signed by a commissioned Forest Warden/Ranger.

II. FIELD OPERATING INSTRUCTIONS

A. General Instructions

The DNR field administrator will:

1. Write burning permits for a period of one year. The year will commence on the date payment is received by the Department.

2. Contact the applicant and determine if a field inspection is necessary, or the permit can be properly conditioned without a field inspection.

    a. If the permit is to be written without inspection, the administrator will notify the applicant to either mail in the fee or pay at the Region office.

    OR

    b. If the permit is to be written with an inspection, schedule an inspection and inform the applicant that should a permit be granted, the fee may be paid by check or money order, made payable to the Department of Natural Resources. The fee may be collected and the permit validated on site by the field administrator. The permittee may start to burn immediately, contingent on smoke management and fire district approval.

3. Condition permit applications to account for variable burning conditions throughout the permit period and to provide a reasonable assurance that escapes and/or smoke intrusions will not occur. Conditioning must have a high emphasis on air quality protection and nuisance prevention.

    Under favorable weather conditions, and if pre-approved by Resource Protection Division, the "additional conditions" section may be modified. In such cases, the new conditions will be attached as an addendum, to the permit, and referenced in the fire danger rating section.

4. Not approve burning if fire danger concerns, air quality protection, and other considerations found in WAC 332-24-217 have not been or cannot be adequately addressed and implemented through appropriate permit conditioning.

5. Not approve or allow any burning within air quality non-attainment areas designated by the Department of Ecology as exceeding the PM-10 and CO standard.

6. Require burn plans for all broadcast burns that have consumable tonnage of 100 tons or greater.

   Individual burn plans may also be required for smaller burns and/or each landing-burning site when a "multi-landing" permit is written.

   Burn plans must be referenced on the face of the burning permit, and do become part of the permit conditions. If burn plans are attached to any permit, the "burn plan" section on the face of the permit document need not be filled out as long as the required information is presented on the burn plan.

7. Use the most current burning permit application form for all burning permits. The completed burning permit application must include:

   a. For burns that will consume greater than 100 tons per 24-hour period:

      (1) A supplemental data sheet with all necessary pre-burn data.

      (2) Provisions for gathering and submitting post-burn data to the Resource Protection Division office within two business days after ignition.

      (3) A burn plan that if referenced on the face of the burning permit application.

      (4) A completed, signed and conditioned burn permit application form.

   b. For burns that will consume less than 100 tons per 24-hour period:

      A completed, signed and conditioned burn permit application form.

8. Enforce all burning permit conditions and other burning requirements in accordance with RCW 76.04.205, WAC 332-24 and the Smoke Management Plan.

9. Inform the burner that failure to comply with rules in Chapter 332-24 WAC voids permission to burn. Any person burning without complying with Chapter 332-24 WAC is in violation of RCW 76.04.205 and Chapter 70.94 RCW. Convictions or bail forfeitures in connection with illegal burning under Chapter 332-24 WAC may result in refusal to issue further permits for a two-year period from the date of the illegal burning. The decision to refuse issuing any further permits rests with the Region.

10. Account for burn permit forms. Write "void" on any damaged or unusable forms, note on the weekly log, and send to the Region office**.**

B. On-Site Inspections

1. Estimate consumable tonnage on the burn site using approved procedures. (See Appendix 3)

2. Determine fee amount using the approved fee schedule.

3. Sign the completed burn permit application and initial any scratch outs or corrections. Use ink to write permits.

4. Collect the check or money order, write the check number on the permit, and validate the permit.

5. Contact the Region office and relay permit information for dispatch use.

6. Complete the burn permit log, staple any fees collected to the office copy, and mail or deliver to the Region office on the same day the permit was validated.

7. Complete the field permit tracking log and send to the Region office weekly.

C. Permits Written Off-Site

1. Conduct a brief telephone training session with the permittee. Answer any questions regarding burning regulations, safe/clean burning practices. Acquire all necessary permit information, including pile size and number of piles. Calculate tonnage from the information given. Write calculated tonnage in the appropriate place on the burning permit form before sending/giving packet to permittee (see 4. below).

2. Instruct the permittee to sign the completed permit application. Enclose all copies of the permit with attachments, PLUS payment in the envelope provided, and send to the appropriate Region office.

3. Remind the permittee that permission to burn does not occur until the permit application is validated and returned to them by the Region office. Also remind the permittee of the requirement to receive permission from the Department on the day they plan to ignite their fire(s).

4. When the permit is to be completed without a site inspection, keep the warden copy, and send or give the permittee a packet that includes:

   a. The completed permit form (plus all attachments);

   b. A pre-addressed envelope to the appropriate Region office; and

   c. A current debris-burning handout with any appropriate inserts (prevention material, etc.).

5. Keep the fourth copy (goldenrod) of the burning permit application for the field administrator's records.

6. Make personal follow-up contact to notify the permittee of permit revocation/suspension, if required.

The landowner or landowner agent will:

1. Sign the burning permit application, enclose all copies of the application, burn plan and data sheet PLUS payment in the envelope provided, and deliver or send to the appropriate Region office to be validated.

OR

Present a check or money order, payable to the Department of Natural Resources, to the field administrator at the time of inspection. Sign the permit and comply with the conditions to burn.

2. Indicate on their permit application and/or check that they wish to open a "debit account," and have the proper amount enclosed ($1,500 minimum opening balance).

3. Indicate if payment is to be applied to an existing "debit account" and what their existing Account Number is.

III. REGION OFFICE OPERATING INSTRUCTIONS

General Duties

The Region office staff will:

A. Receive requests for burning permits from the public and pass along those that require a written permit to the field administrator using normal communication procedures.

B. Receive burning permit applications with attachments plus payment from permittee.

OR

Receive the validated permit with a check or money order attached from the field administrator.

C. Review the burning permit package for completeness and ensure that the correct payment amount has been received.

D. Consult with the field administrator who signed the permit application if any irregularities are noticed or information is missing. Arrange for the errors or omissions to be corrected.

E. Follow Region procedures to decide if too much time has passed between the field administrator's site visit and the date received in the Region office.

F. Develop a filing system to store validated permits and un-validated (but field approved) permit applications and burn plans.

G. Process fees collected using appropriate Department procedures.

H. Validate properly completed permit applications, not already validated by the field administrator, according to the procedures in Appendix 3.

I. Reconcile issued/validated permits with field log and checks received.

J. Notify field administrator and permittee that the permit is suspended if permit fee remuneration cannot be collected (bad check). Instruct field administrator to make a personal visit to permittee if notice cannot be delivered by phone.

K. Create and administer a large burner "debit account" for any burner who plans to burn more than 100 consumable tons, and desires to deposit money with the Department for use against future permit fees. The minimum opening balance for these accounts is $1,500.

L. Transmit pre-burn and post-burn data to Resource Protection Division within specified time periods.

M. Provide Resource Protection Division with the information necessary to operate the 1-800-323-BURN phone system.

IV. OTHER AGENCY OPERATING INSTRUCTIONS

General Procedures

A. Regions may amend existing fire district or other agency agreements or negotiate new agreements to contract for permit writing services. All agreements must be approved by Resource Protection.

B. Other agency personnel who issue burning permits under contract with DNR, on DNR-protected land, must possess a Forest Ranger Commission card.

C. If other agencies are contracted to issue permits on DNR protection, they must also enforce the terms of the permits under the authority of their limited "Ranger Commission" and RCW 76.04 and WAC 332-24.

D. Other agency personnel may process money for the permits they issue on DNR protection. They must use the same procedures, fee schedule, forms, handout material and mailing envelopes used by Region personnel.

Washington State Smoke Management Plan
1993

APPENDIX 5

Smoke Intrusion Reporting Procedures

I. RECEIVING AND PROCESSING COMPLAINTS

A. DNR Regions:

1. DNR Regions will notify Resource Protection, Public Affairs Office and Region where smoke originated (if different) immediately upon receiving smoke complaints from designated areas, if it appears that a smoke intrusion may be taking place.

2. If the smoke is also heading toward a designated area in a neighboring Region, the source Region will immediately notify the receiving Region, Resource Protection and Public Affairs of the situation.

3. All complaints will be forwarded to and handled by the source Region.

B. Resource Protection Division (PBX):

1. Complaints received from the public will be forwarded to the source Region. If the source hasn't yet been identified, mark the locations of a few reporting persons to help in that determination.

2. When transferring calls to the Region, stay on line and ask for the Region's Smoke Management person before releasing the call.

3. After office hours, record the time the call is received, caller's name, number and Region that the smoke intrusion is located in. Alert the Region standby and record the time that the standby person was contacted, on the Telephone Intrusion Report Log. Be sure to advise callers that an investigation is taking place and that someone from the Region will contact them as soon as possible.

4. If a Region officially declares an intrusion, record the time notified on the Telephone Intrusion Report Log and notify <u>one</u> of the following people below in the listed order:

   Resource Protection Assistant Manager, Prevention
   Resource Protection Manager
   Resource Protection, Smoke and Fuels Manager

5. Copies of the Telephone Intrusion Report Log will be filed in the incident file for that smoke intrusion.

II. SMOKE INTRUSION REPORT

A Smoke Intrusion Report (pages 3-4) must be submitted by the Region Manager for all smoke intrusions into designated areas whenever the duration exceeds 30 minutes or for any area when the Region Manager determines the smoke impact on the public warrants submission of the report.

The purpose of the formal intrusion report is to allow a "post-incident" evaluation. The report is intended to bring out observations/conclusions/ recommendations from the Region. Resource Protection will append the meteorological evaluation upon receipt of a Region's intrusion report and forward both to the Department Supervisor.

The intrusion report is submitted to DNR Executive Management within 24 hours of the intrusion. To meet this time limit, the Regions must notify Resource Protection, Smoke Management Section, immediately and the report must be Faxed to Resource Protection at (206) 902-1781.

A summary of the number of verified smoke intrusions that occurred during a calendar year will be included in the annual Smoke Management Report**.**

WASHINGTON DEPARTMENT OF NATURAL RESOURCES
SMOKE MANAGEMENT PROGRAM

SMOKE INTRUSION REPORT/POST-INCIDENT ANALYSIS

COMPLETE FOR **ALL** SMOKE INTRUSIONS BELOW DESIGNATED AREA CEILING HEIGHTS WHENEVER DURATION EXCEEDS 30 MINUTES OR FOR ANY AREA WHEN THE REGIONAL MANAGER DETERMINES THE SMOKE IMPACT ON THE PUBLIC WARRANTS SUBMISSION OF THE REPORT. SUBMIT TO EXECUTIVE MANAGEMENT WITHIN 24 HOURS OF INTRUSION. ALSO SUBMIT A COPY TO RESOURCE PROTECTION (FAX: 360-902-1781). HANDWRITTEN IS ACCEPTABLE. ATTACH ADDITIONAL COMMENTS AS DESIRED.

1. REGION _____ DATE OF INTRUSION _____ TIME OF INITIAL IMPACT _____

2. DURATION (HRS) _____

3. SMOKE CONCENTRATION: ☐ Light ☐ Medium ☐ Heavy
   A. **Light -** Smoke is slightly visible but has minimum impact on air quality or overall visibility.
   B. **Medium -** Smoke has noticeable impact on visibility with minimum air quality and public health.
   C. **Heavy -** Smoke has excessive impact on visibility and air quality with potential adverse impact on public health.

4. ESTIMATED LEVEL OF GREATEST SMOKE CONCENTRATION: ☐ Surface-1,000' ☐ 1,000-2,500'

5. TYPE OF COMPLAINTS: ☐ Health Number _____ ☐ Visibility Number _____
   ☐ Falling Material Number _____ ☐ Other Number _____

6. ESTIMATED SOURCE OF SMOKE: ☐ Slash Burn ☐ Residential Burn ☐ Field Burn ☐ Other

7. ESTIMATED LOCATION AND LANDOWNER AT SMOKE SOURCE: _____

8. LIST SIGNIFICANT PUBLIC CONTACT(S) IN RELATION TO INTRUSION (e.g., Industry, Political, Air Pollution Agencies, Media, etc.) - DO NOT COMPLETE FOR ROUTINE TELEPHONE SMOKE COMPLAINTS. ATTACH SEPARATE COPY OF TELEPHONE COMPLAINT LOG.

NAME	WITH	TIME	DATE

9. ATTACH A COPY OF THE BURN PLAN TO THIS REPORT AND COMPLETE THE FOLLOWING:

   A. NAME/CLASSIFICATION OF PERSON ISSUING BURNING PERMIT.

   B. WAS THE PROPERTY BURNED IN ACCORDANCE WITH THE BURN PLAN? IF NOT, LIST THE DEVIATIONS AND EXPLAIN. SPECIFICALLY ADDRESS EFFORTS/TECHNIQUES TO RAISE A COLUMN.

   C. WHAT WERE THE 10-HOUR FUEL MOISTURES AT IGNITION AND HOW WERE THE FUEL MOISTURES DETERMINED?

   D. ESTIMATE THE TIME THE PROPERTY RECEIVED ITS LAST "WETTING RAIN." (RAIN RECEIVED EARLIER THAN 4 DAYS PRIOR TO IGNITION MAY BE ESTIMATED AS "4 DAYS PLUS." WETTING RAIN IS .1 INCH OR GREATER.)

10. EVALUATE THE OBSERVED SMOKE PLUME BY COMPLETING THE FOLLOWING:

   A. DESCRIBE THE TRAJECTORY OF THE SMOKE IN TERMS OF ALTITUDE ABOVE GROUND LEVEL (AGL) AND GEOGRAPHY (E.G., SMOKE ROSE IN COLUMN TO 2,200' AGL, THEN BENT OVER TOWARDS TOWN "A." CROSSED I-5 ON THE GROUND, PASSING THROUGH TOWN "B" AND DISAPPEARED INTO THE CASCADES).

   B. IF THE SMOKE DID NOT RISE IN A COLUMN TO 3,000', EXPLAIN WHY.

11. WHAT CHANGES IN PROCEDURES/TECHNIQUES ARE NECESSARY TO PREVENT A FUTURE INTRUSION UNDER SIMILAR CONDITIONS?

SUBMITTED BY _____ DATE _____

HH-07 (10/89)

Washington State Smoke Management Plan
1993

APPENDIX 6

1-800 Burning Permit Phone System
Procedures and Responsibilities

The purpose of the 1-800-323-BURN system is to provide the Department with a tool to start or stop all burning under 100 tons on Department-protection and federal lands included in this plan. This includes "rule" burning (except in campgrounds) and "permitted" burning. The system will satisfy the requirement to "call the Department prior to igniting any fire" found in WAC 332-24-205 (6).

The following discussion will describe the tasks and procedures necessary to operate the system. It is important that each Region provide the required information to Resource Protection as specified.

Resource Protection will enter the daily messages onto the system.

I. REGION RESPONSIBILITY

Determine a "script" for their region burning information message with the following information by 1630 hours daily:

A. Determine, by county, whether under 100 ton burning will be allowed or not for fire danger reasons during the next midnight to midnight period. Where Region boundaries overlap county lines, those Regions must decide which one will make the determinations for that county.

B. Provide for internal quality control checks of the daily message. If the Region perceives a problem that cannot be resolved in the region, notify the Resource Protection Communications Supervisor or Fire Regulation Coordinator to resolve them.

C. If burning will be allowed in some counties determine the "adjective class," by county, daily. This determination will be for "tomorrow" and cover the time period of midnight to midnight.

The determination of "adjective class" is necessary so that the public knows on any given day which set of burn permit conditions apply, related to the "adjective class" on their permit, for the county they are burning in.

In order to be consistent in determining "adjective class," statewide, Regions should use predicted Manning class from NFDRS to determine the appropriate adjective class for the next midnight-to-midnight period, as follows:

IGNITION COMPONENT	0-20	21-45	46-65	66-80	81-100
Manning Class	**Adjective Class**				
0 1/	**0**	**0**	**0**	**0**	**0**
1-, 1, 1+	**L**	**L**	**L**	**M**	**M**
2-, 2, 2+	**L**	**M**	**M**	**M**	**H**
3-, 3, 3+	**M**	**M**	**H**	**H**	**V**
4-, 4, 4+	**H**	**H**	**V**	**V**	**E**
5-, 5, 5+	**H**	**V**	**V**	**E**	**E**

Regions will have to use judgment in order to meld the various Manning classes for each shutdown zone into one average Manning class (hence adjective class) per county.

"Adjective class" is only being used for the benefit of the public's understanding. Its relationship to actual fire danger, as predicted by NFDRS, is closely, but not always directly, correlated. By relating "adjective class" to Manning class, there is a relationship to NFDRS predicted fire danger, and gives a rational basis upon which to make an informed and proper determination.

Regions may deviate from the chart above if conditions exist that place a Manning class close to the threshold of the next higher/lower Manning class. In those cases the Regions must exercise judgment.

D. Using the developed script, record the daily prevention messages and the appropriate adjective classes and “burn” or “no burn” messages onto the system by 1700 daily.

E. Maintain a written record of each message placed on the system suitable for entry into State legal/court records.

F. Monitor the completed daily message for your Region, and be sure that the information is transmitted to the field administrator’s daily.

II. RESOURCE PROTECTION RESPONSIBILITY

A. Gather input about air pollution episodes and impaired air conditions from the Department of Ecology and enter a burn or no burn message for air quality, in the

counties affected. This is the only time Resource Protection Division will be recording messages.

B. Maintain the system with vendors.

F. Monitor the system messages at least three times per week.

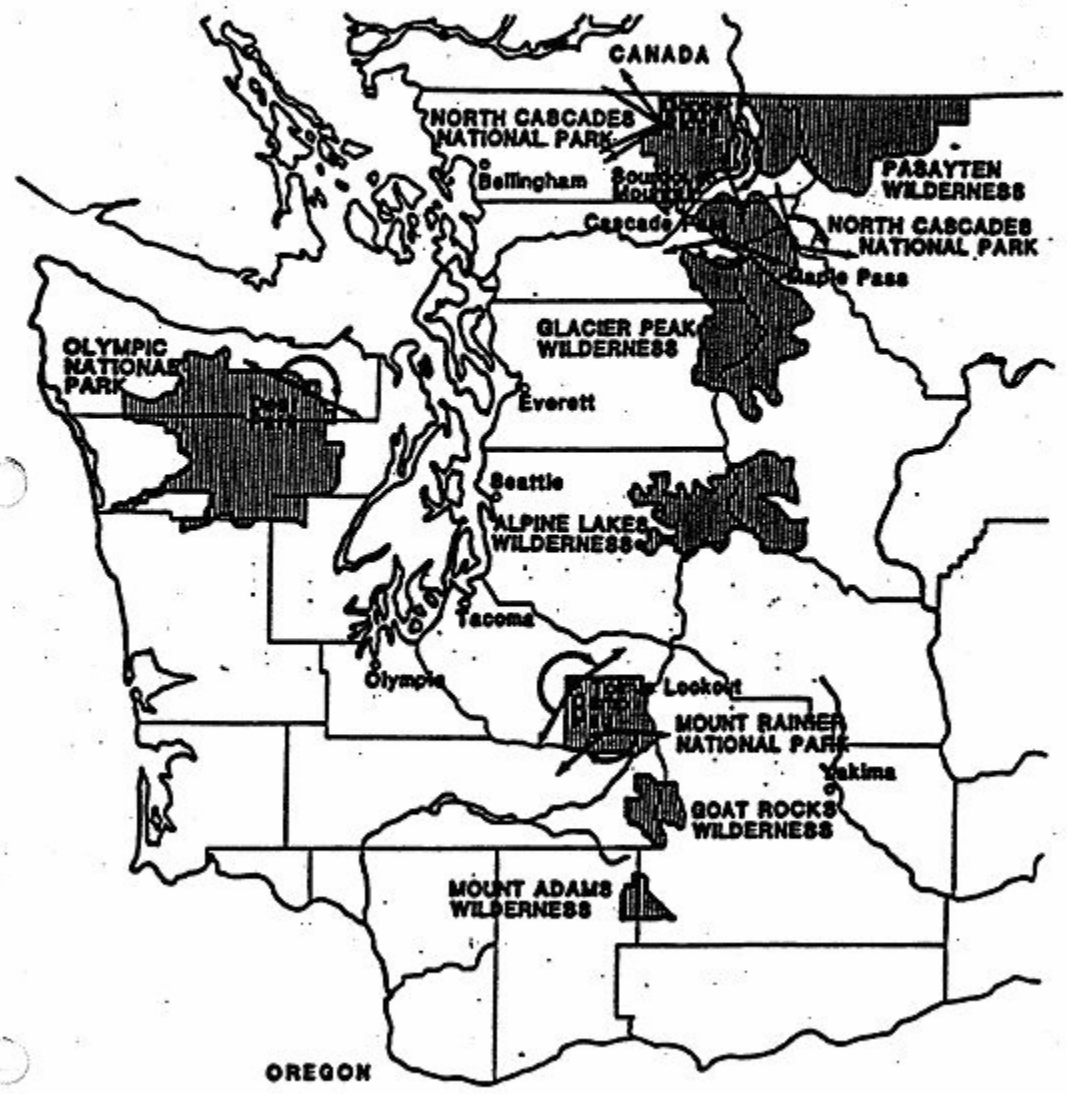
III. GENERAL

The scripts used for each Region will be based upon a Region wide message with a county-by-county message option when required. No subdivision smaller than a county will be used.

(Exceptions to this would be where distinct climate variations exist within a county and the Region desires to turn burning "on" and "off" based on that variation (e.g., east and west Clallam/Jefferson County). If this were done, a distinct and VERY EASILY identified and understood dividing line would be used to make the distinction. (We are NOT encouraging any deviation from county-by-county subdivisions; for both cost and public confusion reasons.)

APPENDIX 7

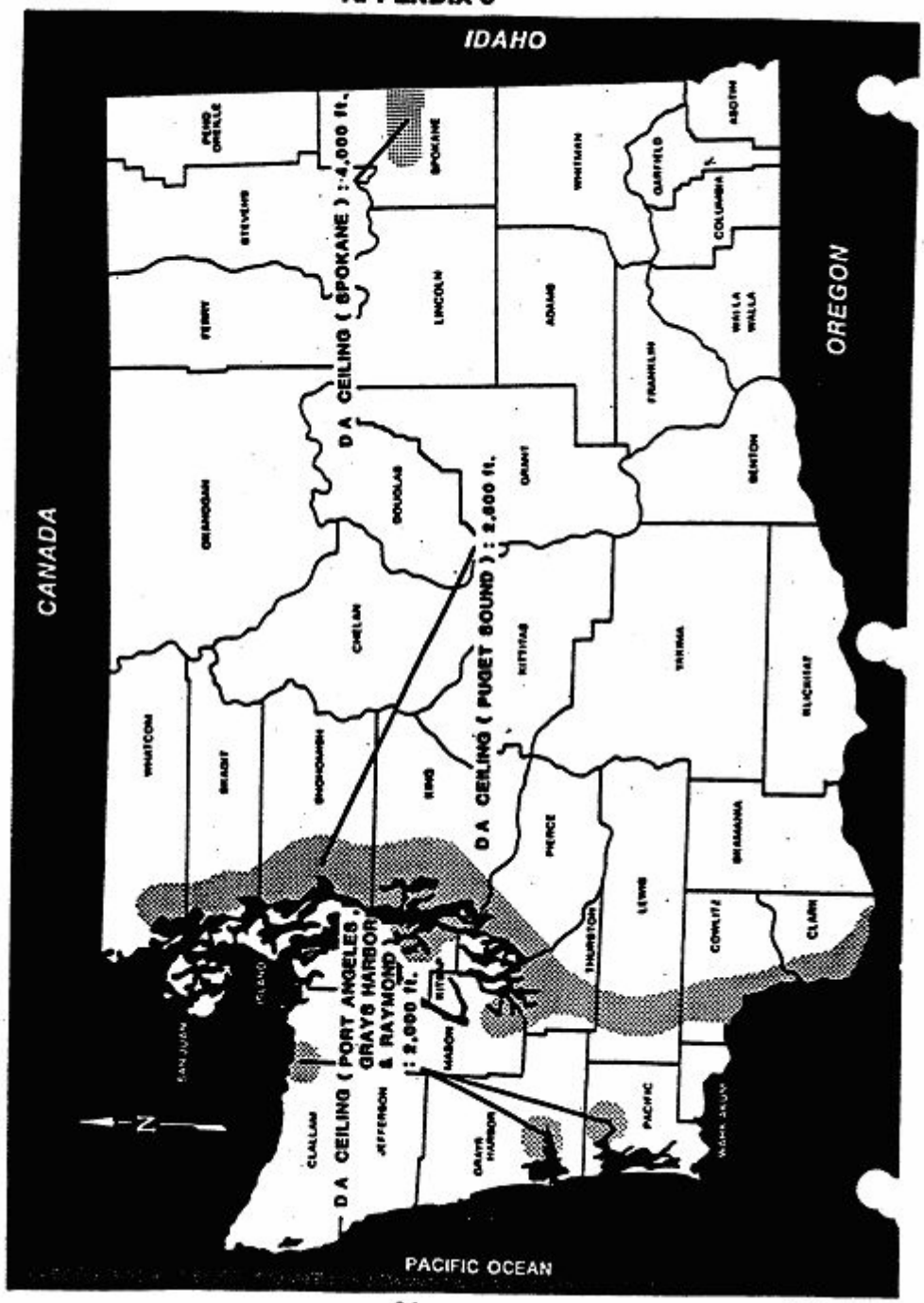
State of Washington
Federal Class I Areas



7-1 2/93

APPENDIX 8

State of Washington
Designated Areas (DA) for Air Quality Control



8-1

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APPENDIX 9

Ambient Air Quality Standards

POLLUTANT	NATIONAL		WASHINGTON STATE
	PRIMARY	SECONDARY	
Total Suspended Particulates **Annual Geometric Mean** **24-Hour Average**	**No Standard** **No Standard**	**No Standard** **No Standard**	**60 μg/m^3** **150 μg/m^3**
Particulate Matter (PM_{10}) **Annual Arithmetic Mean** **24-Hour Average[2]**	**50 μg/m^3** **150 μg/m^3**	**50 μg/m^3** **150 μg/m^3**	**50 μg/m^3** **150 μg/m^3**
Particulate Matter ($PM_{2.5}$) **Annual Arithmetic Mean** **24-Hour Average[3]**	**15 μg/m^3** **65 μg/m^3**	**15 μg/m^3** **65 μg/m^3**	**No Standard**
Carbon Monoxide (CO) **8-Hour Average** **1-Hour Average**	**9 ppm** **35 ppm**	**No Standard**	**9 ppm** **35 ppm**

ppm = parts per million.
μg/m^3 = micrograms per cubic meter.

[2] Based on three year average of 99th percentile.

[3] Based on three year average of 98th percentile.

APPENDIX 10

Overview of SMS-INFO

By
Roger D. Ottmar
April 1, 1992

BACKGROUND

The Fire and Environmental Resource Applications (FERA) group is a component of the Global Environmental Protection Program, Pacific Northwest Research Station, USDA Forest Service. Through research, FERA has created knowledge about the factors that influence fuel consumption and emissions production during a prescribed burn. FERA has developed a computer program known as SMS-INFO to improve the quality of information used by policy makers in developing air quality and smoke management programs. The program will read prescribed burn records that have been electronically mailed to the State regulatory agencies and estimate the amount of fuel consumption and emissions produced by each burn.

SYSTEM CONTENT

The SMS-INFO program serves as part of the decision support system used by State regulatory agencies to implement air quality and smoke management systems. SMS-INFO will: (1) read prescribed burning records that have been electronically mailed to a State agency; (2) validate the integrity of the data; (3) generate pre-event and post-event estimates of consumption and emissions; and (4) write estimates to ASCII text files that can be imported into commercial software - such as a database management system, spreadsheet, or word processor - for further analysis and reporting by State agencies.

SCIENCE OVERVIEW

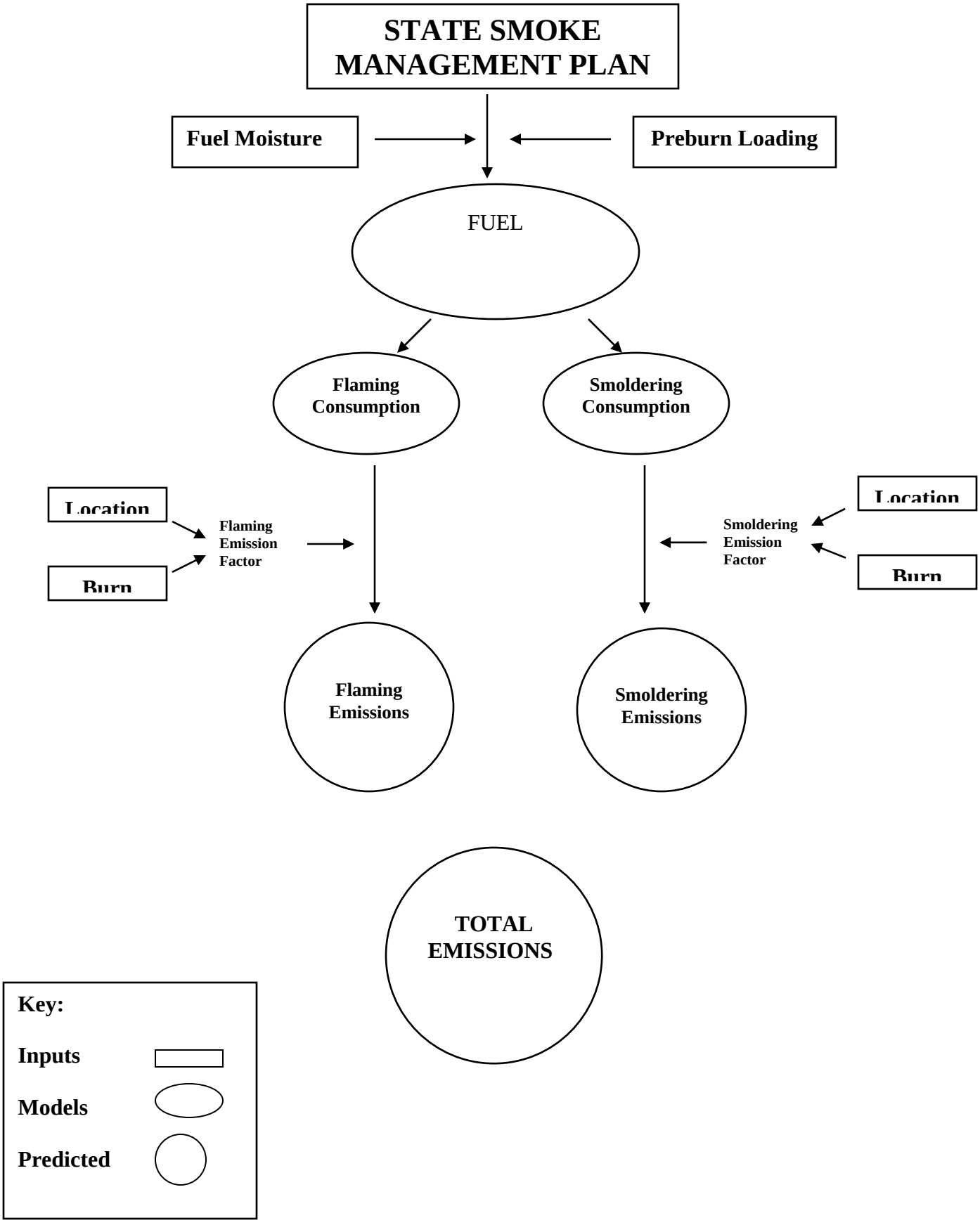
Fuel consumption and smoke emission measurements were collected from nearly 175 operational prescribed burns on Forest Service, State, and private lands in the Pacific Northwest during the 1980s. These measurements were used to develop the fuel consumption algorithms and emission factors for the flaming and smoldering combustion phases currently in SMS-INFO. The program includes algorithms to provide fuel consumption estimates for small fuels, large fuels, uncured fuels, duff, high intensity fires and spring-like burning conditions. Emission factors (pounds of emissions per ton of fuel consumed) for Douglas Fir/Western Hemlock, coastal hardwoods, mixed conifer, pine and piled slash are contained within the program.

The small woody fuel consumption models are based on 10-hour fuel moisture content (most important variable), with adjustments for wind speed and slope. The large woody fuel consumption algorithm is based on large fuel moisture content (most important variable), with adjustments for high small fuel moisture contents, rapid ignition and uncured fuel moisture. The duff consumption algorithm is based on large fuel consumption (most important variable) and days since significant rain. The emission factors (amount of smoke per ton of fuel consumed)

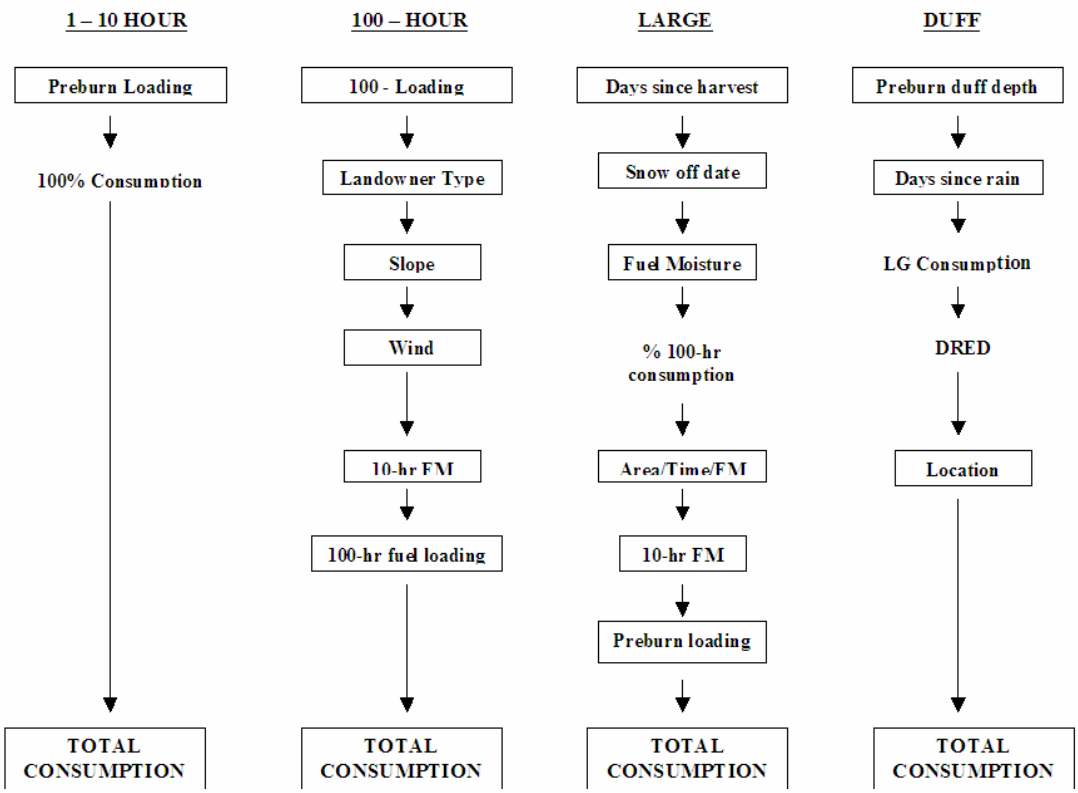
are based on the type of burn (partial cut, clear cut or pile). Adjustments are also made for species of fuels.

The program calculates the amount of fuel consumed by combustion stage based on weather, fuel moisture and unit information provided on the Smoke Management Report. The fuel consumed is multiplied by an emission factor to calculate total emissions produced (Figure 1).

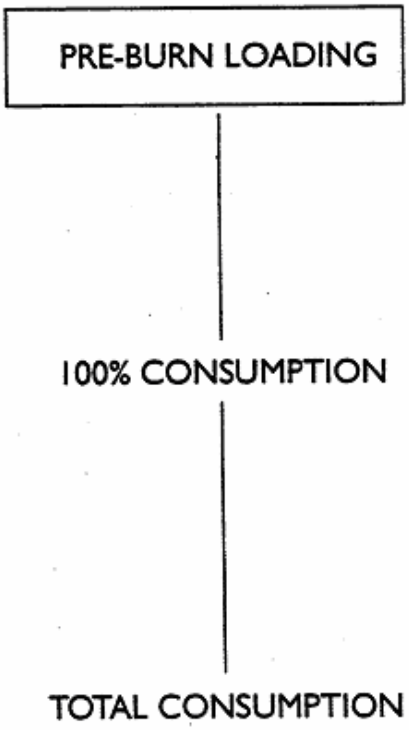
The reader must keep in mind that the models within SMS-INFO will always be changing as new research is applied and improved models are developed. In certain cases, preliminary models are used as the best tool available at this time. This document describes the fuel consumption and emission algorithms as they currently exist in SMS-INFO.


STATE SMOKE MANAGEMENT PLAN
Fuel Moisture
Preburn Loading
FUEL
Flaming Consumption
Smoldering Consumption
Location
Burn
Flaming Emission Factor
Smoldering Emission Factor
Location
Burn
Flaming Emissions
Smoldering Emissions
TOTAL EMISSIONS
Key:
Inputs
Models
Predicted

FUEL CONSUMPTION MODEL

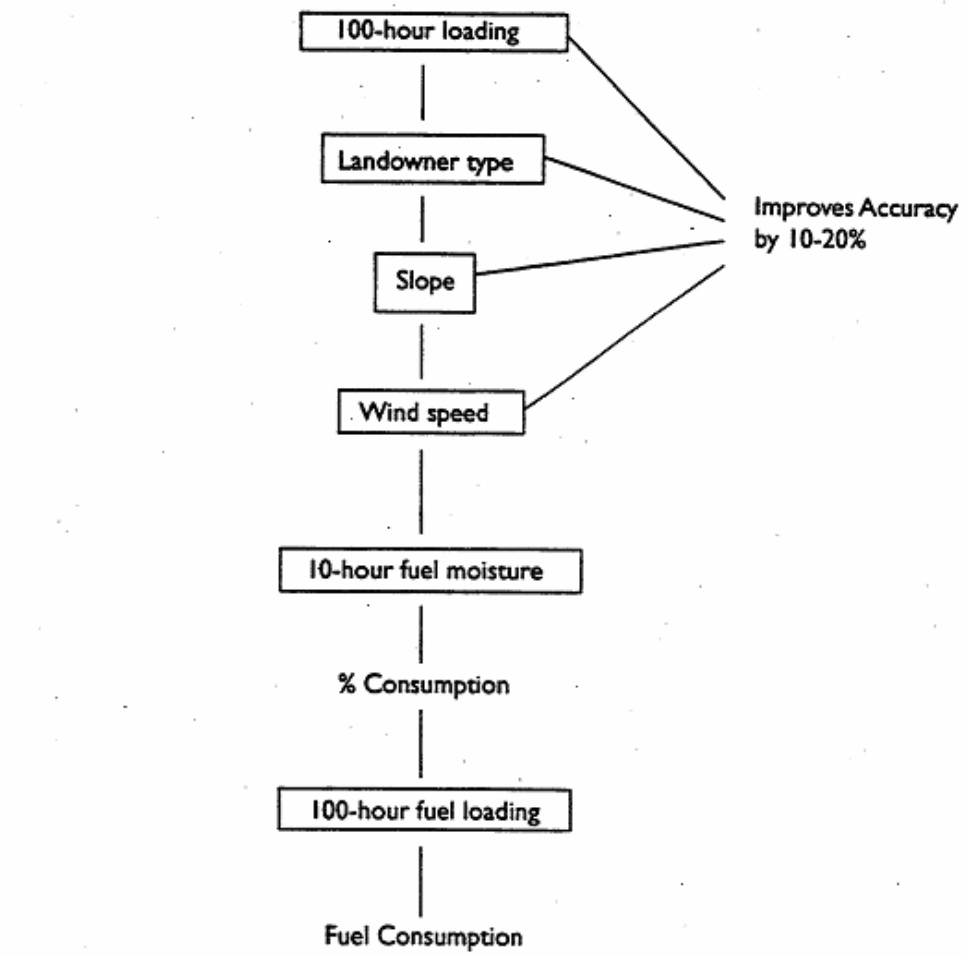


FINE FUEL CONSUMPTION
(1-hour & 10-hour)

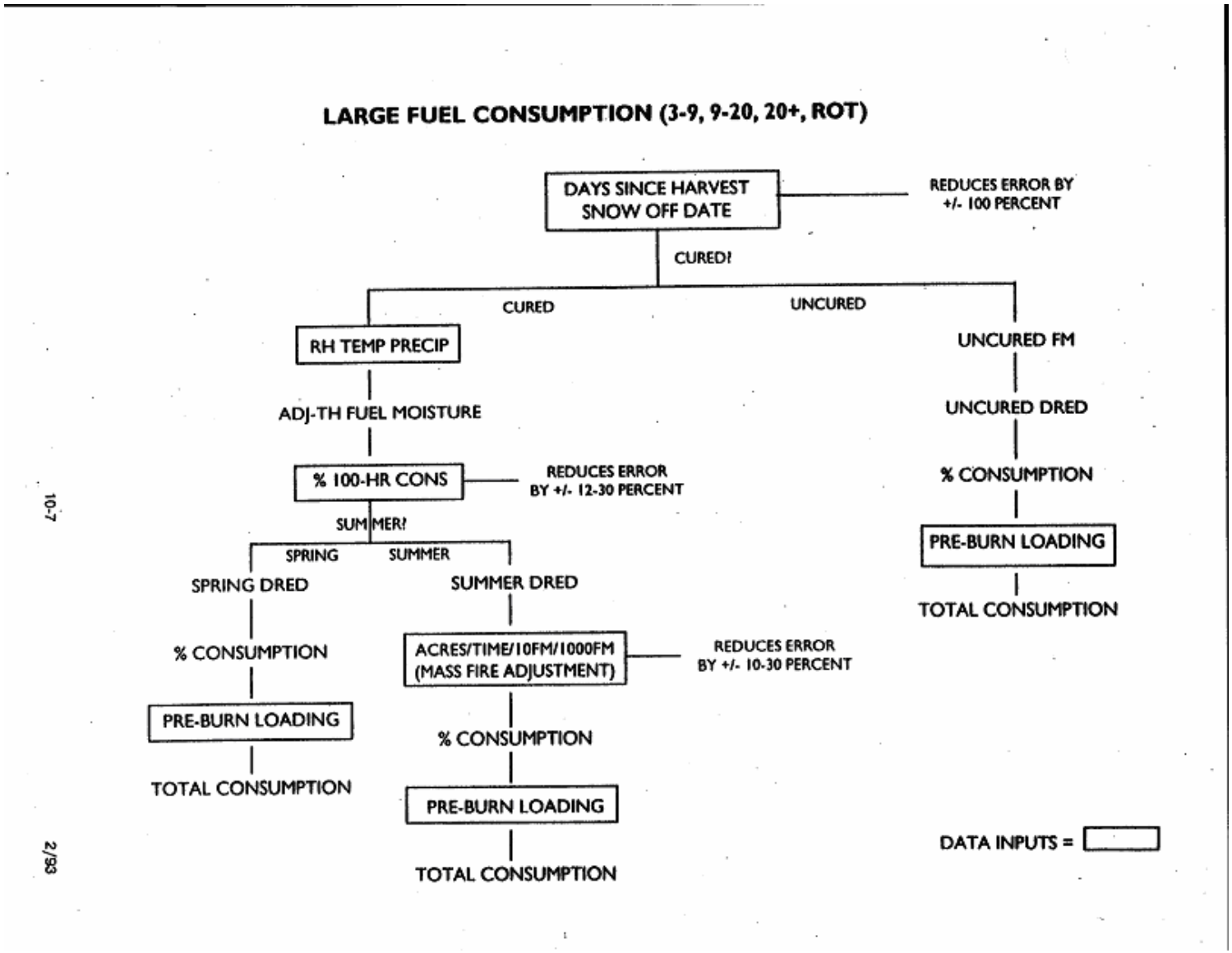


Data Input

100-HOUR FUEL CONSUMPTION



Data Input


LARGE FUEL CONSUMPTION (3-9, 9-20, 20+, ROT)
DAYS SINCE HARVEST
SNOW OFF DATE
REDUCES ERROR BY
+/- 100 PERCENT
CURED?
CURED
UNCURED
RH TEMP PRECIP
ADJ-TH FUEL MOISTURE
% 100-HR CONS
REDUCES ERROR
BY +/- 12-30 PERCENT
SUMMER?
SPRING
SUMMER
SPRING DRED
% CONSUMPTION
PRE-BURN LOADING
TOTAL CONSUMPTION
SUMMER DRED
ACRES/TIME/10FM/1000FM
(MASS FIRE ADJUSTMENT)
REDUCES ERROR
BY +/- 10-30 PERCENT
% CONSUMPTION
PRE-BURN LOADING
TOTAL CONSUMPTION
UNCURED FM
UNCURED DRED
% CONSUMPTION
PRE-BURN LOADING
TOTAL CONSUMPTION
DATA INPUTS =
10-7
2/93

DUFF CONSUMPTION
Data Input
Pre-burn Duff Depth
Days Since Significant Rain
Moisture Regime?
WET DUFF REGIME
Large Fuel Consumption
Duff Reduction
Location
Bulk Density
Duff Consumption
MOIST DUFF REGIME
Diameter Reduction
Duff Reduction
Location
Bulk Density
Duff Consumption
DRY DUFF REGIME
Pre-burn Duff Depth
Duff Reduction
Location
Bulk Density
Duff Consumption
10-8
2/93

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APPENDIX 11

Authorities

RCW 76.04 FOREST PROTECTION LAWS

The Revised Code of Washington (RCW) 76.04.205 requires that persons shall have a valid written burning permit obtained from the Department of Natural Resources to burn:

Flammable material on lands protected by the Department; or

Refuse or waste forest material on forest lands protected by the Department.

The conditions under which a permit may be issued include:

". . . burning will be done in compliance with Air Quality Standards established by Chapter 70.94 RCW."

WAC 332-24 BURNING PERMITS

Specific requirements for burning on Department protected lands are listed in the Washington Administrative Code chapter 332-24. WAC 332-24-205(13) provides that the Department may impose additional requirements for all burning on its protection through the use of written burning permits and/or the Smoke Management Plan. WAC 332-24-221(3)(a) specifies that written burning permits are not valid unless the burner agrees to follow all terms of the permit and requirements of the Smoke Management Plan.

RCW 70.94 WASHINGTON CLEAN AIR ACT

The Washington Clean Air Act, RCW 70.94.660, gives the Department of Natural Resources ". . . responsibility for issuing and regulating burning permits required by it relating to the following activities for the protection of life or property and/or for the public health, safety, and welfare:

A. Abating a forest fire hazard;

B. Prevention of a fire hazard;

C. Instruction of public officials in methods of forest firefighting;

D. Any silvicultural operation to improve the forest lands of the state; and

E. Silvicultural burning used to improve or maintain fire dependent ecosystems for rare plants or animals within State, federal and private natural area preserves, natural resource conservation areas, parks, and other wildlife areas."

The Washington Clean Air Act, RCW 70.94.665, also requires that ". . . the Department of Natural Resources shall administer a program to reduce statewide emissions from silvicultural forest burning . . ."; and that "the Department of Natural Resources shall develop a plan, based upon the existing smoke management agreement to carry out the programs as described in this section in the most efficient, cost effective manner possible**."**

RCW 70.94.745 states that, "It shall be the responsibility and duty of the Department of Natural Resources, Department of Ecology (DOE), Department of Agriculture, fire districts, and local air pollution control authorities to establish, through regulations, ordinances, or policy, a limited burning program for the people of this State . . ."

UNITED STATES CLEAN AIR ACT (CAA)- 42 USC 7401 ET. SEQ. - AIR POLLUTION PREVENTION AND CONTROL

42 USC 7470

This section establishes a national goal for "the prevention of any future, and the remedying of any existing, impairment of visibility in mandatory Class I federal areas which impairment results from manmade air pollution." Mandatory Class I federal areas were defined in 42 USC 7491 of the CAA as all international parks, all national wilderness areas and memorial parks which exceed 5,000 acres in size, and all national parks which exceed 6,000 acres in size. In the State of Washington, eight such Class I areas exist, including three national parks (North Cascades, Olympic, and Mt. Rainier) and five wilderness areas (Alpine Lake, Glacier Peak, Goat Rocks, Mount Adams, and Pasayten).

In response to the requirements of the CAA, the United States Environmental Protection Agency (EPA) promulgated its rule for visibility protection for federal Class I areas (45 CFR 80089). The rule requires states to develop programs to assure reasonable progress toward meeting the national visibility goal.

42 USC 7418

Federal agencies are subject to enforcement actions for violations of the Smoke Management Plan under 42 USC 7418 of the Clean Air Act. It states in 42 USC 7418, that "Each . . . agency . . . of the federal government . . . engaged in any activity resulting . . . in the discharge of air pollutants . . . comply with all federal, State, interstate, and local requirements. . . respecting the control and abatement of air pollution in the same manner, and to the same extent as any non governmental entity."

"The preceding shall apply to any requirement . . . including record keeping or reporting . . . permits . . . and any other requirement whatsoever . . . to pay a fee or charge . . . to defray costs of . . . air pollution regulatory program . . ."

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APPENDIX 12

Baseline Calculation and Options

I. PURPOSE

The 1990 amendments to the Washington Clean Air Act require that fire emissions be reduced from previous years' average. This appendix describes the method used to calculate the average annual fire emissions.

II. STATEMENT OF THE PROBLEM TO BE SOLVED

The Washington Clean Air Act of 1991 (WCAA) directs the Department of Natural Resources (DNR) to ". . . administer a program to reduce statewide emissions from silvicultural forest burning . . ." The Act further directs minimum annual emission reduction requirements:

A. A "20 percent reduction by December 31, 1994, which would be a "ceiling for emissions until December 31, 2000."

B. A "50 percent reduction by December 31, 2000," which would be a "ceiling for emissions thereafter."

The desired calculation determines a consistent, efficient and cost-effective technique to determine average annual emissions and determines future annual emissions from silvicultural forest burning.

III. FACTORS IN SOLVING THE PROBLEM

A. Identification of "Emissions" to be Monitored for Reductions

1. When wood is burned, the smoke is comprised of a number of particles and gases. The USDA Forest Service's (USDAFS) Pacific Northwest Forest and Range Experiment Station (PNW) analyzed the amount and composition of wood smoke from prescribed fires in the Northwest during the 1980s. Their studies established content and volume of particulate matter and gas(es) emitted into the atmosphere, per ton of vegetative matter consumed (i.e., type of wood,

sage, juniper). These emission factors and standards were accepted by the U.S. Environmental Protection Agency (EPA).

2. Of the several wood smoke emissions, particulate matter 10 microns (PM-10) and smaller in diameter is the standard for measuring emissions reduction. There are five reasons for that standard:

   a. PM-10 and smaller particles are carried by air currents up to several miles away from the immediate fire site and can have widespread impact. Particles larger than PM-10 fall back to earth, near the fire site.

   b. PM-10 and smaller particles are small enough to travel through human breathing passages to the lungs.

   c. PM-10 and smaller particles affect visibility.

   d. PM-10 and smaller particles are measured throughout Washington in an established air sampler network monitored by the Department of Ecology (DOE).

   e. PM-10 standards are established by the EPA.

B. Measuring Performance

PNW research during the 1980s led to a computer model which calculates fuel consumption from silvicultural burning and the emissions of PM-10. When emission measuring methods were evaluated, the PNW method was selected as the most practical and accurate.

C. Data Availability, Reliability, Limitations

1. Data necessary to run the PNW model was not defined during the study period and, therefore, not collected. The PNW model data requirements are primarily fuel loading, fuel moisture and duff depths.

2. During the study period, complete records for fires consuming over 100 tons of fuel were available. However, the data was incomplete because fuel loading, fuel moisture and duff depth were not collected for most burns.

3. There were no records for under 100-ton burns other than DNR's accounts of burning permits issued to private land managers and DNR-managed property.

4. To accommodate the absence of data, the following estimations were made:

   a. For over 100-ton burn records collected during the study years:

      (1) All broadcast and underburn data was used if collected.

(2) If data was not collected for broadcast and underburns, average fuel moistures were set at 10 percent for 10-hour fuels and 20 percent for 1000-hour fuels. Fuel loadings and duff depths were estimated by using the average values from the 1987 PNW biomass study.

(3) All pile and landing data was used as reported.

b. For under 100-ton data, three assumptions were made:

(1) An annual average of 8,000 permits were issued for private land managers and 550 permits for DNR-managed land. The USDAFS burned the same ratio of over 100-ton burns to under 100-ton burns as in 1993 (for which data is available). The totals were adjusted to subtract the existing records of over 100-ton burns.

(2) Two separate studies were undertaken to determine the average consumption in under 100-ton burns. Both indicated values near 50 tons, the mean of a normal distribution. Each under 100-ton burn was assigned a value of 50 tons consumed.

(3) All under 100-ton burns are assumed to be pile burns. This is considered a good assumption, since only a very small percentage of the under 100-ton burns in 1993 were broadcast or underburns.

IV. CALCULATED BASELINE VALUES

The average number of tons of PM-10 attributed to silvicultural burning emitted into Washington's atmosphere for 1985-1989 was 17,250 tons.

The following table summarizes the PNW model calculations:

BASELINE - THE AVERAGE OF 1985-1989 TOTALS
IN TONS OF PM-10

LAND MANAGER	1985	1986	1987	1988	1989	STATE AVERAGE
Private	14,407	11,663	9,922	9,655	10,336	11,196
DNR-Managed	1,448	1,436	929	496	419	946
USDA Forest Service	5,000	5,969	4,938	4,691	4,476	5,015
Nat'l Park Service	7	7	7	7	7	7
US Fish & Wildlife	21	21	21	21	21	21
US Army, Ft. Lewis	47	63	59	83	73	65
Yearly Average	20,930	19,159	15,876	14,952	15,331	17,250

V. CORRELATION WITH PRIOR SMOKE MANAGEMENT REPORTS

Smoke Management reports have been produced annually since the mid-1970s. The reports used acres burned as reported fuel consumption and total number of burns as measures of prescribed fire activity. The over 100-ton statewide data totals for 1985-1989 hand-calculated reports were compared to the output of the PNW reports.

SMOKE MANAGEMENT REPORTS (SMR)/PNW MODEL (PNW)

	NUMBER OF IGNITIONS		ACRES TREATED		CONSUMED TONS OF FUEL	
	SMR	PNW	SMR	PNW	SMR	PNW
1985	1,176	1,161	93,094	88,676	1,596,894	1,900,986
1986	1,246	1,274	84,397	83,664	1,206,685	1,904,942
1987	1,065	1,049	81,318	62,949	1,130,973	1,362,587
1988	1,172	1,197	53,772	56,704	816,703	1,162,465
1989	1,330	1,323	56,046	56,063	809,542	1,166,349

Data comparisons reveal some differences. A detailed analysis of the differences is not possible since the 1985-1987 reports were done by hand-calculation, for which there are no "draft notes" other than the published Smoke Management reports. The 1988 and 1989 records used the same original data that was used for the PNW model input. In preparing a final set of data, some new records were entered for the sake of completeness and some records were deleted when obvious errors were found and which were not revealed in earlier reports generated from the data base.

Consumed tons of fuel are not expected to be equivalent. The research conducted at PNW during the 1980s documented that the differences in fuel estimates was "too low." That conclusion resulted in the default values being used as discussed in the preceding section. As expected, the fuel consumption is higher for the PNW model.

In conclusion, the data used for the PNW model for 1985-1989 are reasonably accurate.

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APPENDIX 13

Program Cost Distribution Method

Fees that are levied by the Department to cover the costs of the Smoke Management Program are determined using the methodology developed with the assistance and endorsement of the Forest Fire Advisory Board (FFAB). The Department may deviate from this method in the future if circumstances warrant and after consultation with the FFAB.

There are three key components used to determine the proportional share of total costs that each manager group of this plan will contribute:

A. The percent of emissions that each manager group produces, based upon historical data.

B. The percent of program budget the Department expends on each group to operate the program.

C. The percent of operating costs related to smoke management vs. fire regulation.

METHOD DESCRIPTION

A. Total program costs are divided into two categories: fixed and operating.

B. The total fixed costs are then distributed between manager groups based upon the percent of emissions that each group produced based on historical data.

C. The total operating costs are distributed between manager groups based upon percent of budget expended on each group.

D. The resulting fixed costs and operating costs are added together for each manager group to derive the total weighted share of costs to be borne by that group.

E. Beginning with the total weighted share derived in (D) above for the State and private administrative group, costs are again proportioned between small burners (less than 100 tons consumed) and large burners (greater than 100 tons) using the same criterion shown in (A) through (D).

F. The operating cost that was calculated for the "less than 100 ton" sub-group is multiplied by .75 to derive the smoke management portion of those operating costs, and the operating cost that was calculated for the "greater than 100 ton" sub-group is multiplied by .25 to arrive at the smoke management portion of those operating costs.

G. Adding 100 percent of the fixed cost to the weighted operating costs derived in (F) above provides the proportion of total cost to be borne by each sub-group.

WEIGHTED PROPORTION METHODOLOGY

Cost Allocation Work Sheet
Major Burner Groups

	Fixed Costs	Operating Costs	Weighted Share of Costs
Federal/Tribal	**(46%) $148,295**	**(6%) $34,387**	**$182,682**
State/Private	**(54%) $174,086**	**(94%) $538,735**	**$712,821**
Total	**$322,381**	**$573,122**	**$895,503**

State & Private Sub-Group Calculation

	Fixed Costs	Operating Costs		Weighted Share of Costs
Burns < 100 tons	**(32%) $ 55,707**	**(91%) $490,428 x (25%) = $122,562**		**$178,270 (54%)**
Burns > 100 tons	**(68%) $118,378**	**(9%) $ 48,486 x (75%) = $ 36,364**		**$154,742 (46%)**
Total	**$174,086***	**($538,735*)**	**$158,926**	**$333,012**

General Fund would pay fire prevention related activities **$379,809**

Fees and permits would pay smoke management related activities **$515,684**

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APPENDIX 14

Alternative Debris Disposal Techniques

In this section a description and evaluation of the different alternatives for site treatment, other than prescribed burning, that we are currently aware of will be given. In most instances each of these treatments may be used alone or in conjunction with another treatment. Each alternative should be evaluated for operational limitations, soil quality, human health effects, and economics.[4] The alternatives are:

I. Alternative mechanical treatments

II. Increased utilization

III. Chemical

IV. Manual

V. No treatment

I. ALTERNATIVE MECHANICAL TREATMENTS

A. Low ground pressure tractors (cats and skidders), used for:

1. Piling

2. Forest cultivation

3. Slash orientation

Description: Crawler tractors or low ground pressure tractors outfitted with various types of blades or mowing attachments are the most commonly used methods on slopes less than 35 percent. Site preparation is most often accomplished using brush blades (blade with a rake attached) to pile unmerchantable logging material, brush and sometimes part of the top layers of soil. The action is named for the extent of the activity. For example, preparing planting spots is called scalping; plowing a strip is called furrowing or contouring. In addition there are different attachments available for realigning logging debris, crushing and grinding debris, and disking.

The advantages of low ground pressure tractors are the low costs and high efficiency of treatment. In many cases, the plant, roots and all, are removed.

The disadvantages of low ground pressure tractors are: 1) intense disturbance of site with this type of equipment, particularly during site preparation, 2) most techniques are nonselective and remove non-target plants, 3) there are slope and topographic

[4] A Report on "Prescribed Burning in Oregon," Paul Bell, Don Matlick, Mike Ziolko, 1990.

limitations and 4) there is usually some re-sprouting if the whole plant is not removed.

The following are general restrictions which apply to tractors (both rubber-tired and crawler) due to site protection and equipment limitations. Tractors are generally prohibited on slopes exceeding 35 percent, to avoid adverse impacts. Tractors are prohibited on critical soils, such as those with high compaction potential, except at designated locations where significant, adverse impacts can be avoided. In most cases, tractors are prohibited on soils with high erosion and sedimentation hazard. Tractors may be limited to operating only during certain periods in order to maintain long-term productivity of forest and range soils. Timing of operations are based on soil moisture content and soil properties in order to reduce compaction.

Average costs for these types of site preparation have been approximately $135 per acre. This will vary greatly according to circumstances and types of equipment. Some representative Forest Service costs have been:

1. Dozer with blade - $80-$100/acre
2. Ripping and piling - $75-$160/acre
3. Disking - $70-$80/acre
4. Track-Mac - $150-$250/acre

B. Track-mounted excavators:

1. Standard bucket and thumb
2. Slash grinder
3. Modified grapple

Description: Track-mounted excavator outfitted with various types of attachments for logging and site preparation, most commonly used as log loaders and shovels. Site preparation is most often accomplished using the grapples or bucket and thumb to pile logging debris or to create planting spots.

New developments include attachments which can be used to create planting spots in logging debris, road side clearing and pre-commercial thinning. These attachments accomplish this by grinding slash down to mineral soil on the desired number of planting spots per acre. In the process, the logging debris is reduced eliminating piles and the need for burning.

Another attachment which can be used for site preparation is a device similar to the grapples on a loader only modified into a clam configuration. This is a versatile accessory which can be used for site preparation, log handling, excavation and road building. Its value for site preparation is to create planting areas on a spot by spot basis, or to pile logging debris.

The advantages of track-mounted excavators are they may be used on: 1) slopes as great as 50 percent under proper conditions, 2) rough terrain, and 3) more fragile site conditions. They also create less soil disturbance. If burning is an objective, they can construct cleaner piles by being selective on the type of material that is piled. For example, a contract may specify that larger fuels be left on the ground in a natural arrangement.

Disadvantages to the track-mounted excavator are higher costs, and they may require a larger lowboy than other mechanical options do to move them into a site.

Average costs for track-mounted excavators vary greatly depending upon the type of equipment and terrain they are working on. Some average costs for piling slash are:

1. Bucket and thumb - $125-$200/acre

2. Slash grinder - $150-$250/acre

3. Modified grapple - $125-$190/acre

C. Walking excavator:

1. Standard bucket and thumb

2. Slash grinder

3. Rake (to be constructed)

Description: A walking excavator has individually operated legs and wheels which allow it to operate almost anywhere. It can work up, down, or across steep slopes. It has the capability to climb over 5-foot obstacles without touching them. It can adapt its base to rough terrain of all kinds while the operator sits in an upright position. Operating weight is 14,300 pounds distributed over two large flotation tires and two 24-inch outrigger pads for very low ground pressure. At this time, the machine operates with a selection of buckets which can be used for piling or wind-rowing debris and creating planting spots. Optional attachments are now being developed which will give the machine more versatility and make it more efficient. The attachments being considered for development include a slash grinder head, grapples and a rake.

The advantages of a walking excavator include those for track-mounted excavators in addition to the following. With the proper modification this machine can work on unlimited slopes with very minor site disturbance. It does not require a lowboy to be transported from site to site. Due to its configuration it may work in environmental sensitive areas with very light site impact.

Disadvantages to the walking excavator include its size limitation and its lack of proved production. The walking excavator has a maximum boom reach of 26 feet and currently is only available in the one size. The small size and low horsepower of this machine may adversely affect its production rates making it uneconomical to operate. At this time there are no production results to judge cost effectiveness, having not been tested.

At this time there are no treatment costs available for the walking excavator. We are in the process of setting up a local demonstration to evaluate the equipments capabilities.

D. In-unit mobile chipper:

Description: This technique involves mounting a chipper on an all-terrain vehicle which can move about a logged unit similar to skidding equipment. In addition to the chipper, a grapple loader can be added to feed the machine. Its purpose is to chip logging slash which results in a change of the arrangement and physical characteristics of the slash. Through this process, unit slash can be reduced and rearranged to provide planting spots and meet hazard abatement requirements.

The advantages of this system are to reduce slash hazard and create planting spots while being selective in treatment. The process can be accomplished with minimum site disturbance leaving soil and duff intact, unlike the piling of other ground machines. In addition, the chips can be left distributed on the site aiding in the retention of soil nutrients and soil moisture. This machine can be used to chip landing piles and road right-of-way slash for hog fuel and with additional development, clean chips may be a possibility.

Disadvantages of this system are the current high cost per acre of operation and the availability of this type of equipment. An average cost for site preparation is $350 per acre (Sunrise Tree Service).

As with all other methods, the timing of application can affect the success and efficiency of the operation when using mechanical methods. Application is usually timed to avoid sprouting of brush and high soil moisture content.

Adverse health effects using mechanical methods are that operators and other workers are in the vicinity of the equipment. Serious injuries can result if an operator loses control of the machine on steep terrain. Such accidents are uncommon among experienced operators, but they are difficult to avoid entirely. Workers can be struck by falling trees or debris thrown by the equipment while it is in operation, especially when brush cutters or mowers are being used. Minor injuries are almost certain to result from the use of mechanical equipment, however severe injuries are rare.[5]

II. INCREASED UTILIZATION

Set minimum yarding specifications (6 foot x 6 inches, etc.).

A. Chips for hog fuel

B. Chips for co-generation plants

C. Clean chips

Description: Various, opportunities exist under this option to set several different yarding specifications. They could include everything from a minimum size specification

[5] **United States Department of Agriculture, Forest Service, Pacific Northwest Region, 1988. Managing Competing and Unwanted Vegetation, Final Environmental Impact Statement.**

of 4 feet x 4 inches to whole tree yarding. The material is yarded into the different landings. Once the yarded unmerchantable material (YUM) is collected it may be sold as firewood, chips for hog fuel, chipped for co-generation plants or debarked and chipped for clean chips. The extent that a unit should be YUM yarded depends upon current market conditions, and/or the Land Managers objectives for the amount of logging debris which should be left to meet reforestation objectives. If the objective is to reforest without burning, the specifications would have to be set on the predicted amount of slash that will accumulate on the unit. If a determination is made that YUM yarding cannot be accomplished to the extent that reforestation is possible, the objective could be to YUM enough to reduce the amount of duff that might be consumed when burning, thus reducing emissions.

Past studies show that woody fuel consumption averaged 24 percent less on units yarded to 6 inches x 6 feet, and 44 percent less on units yarded to 4 inches x 4 feet when compared to units yarded to 8 inches x 10 feet.[6]

The advantages of intensive yarding would be to decrease the amount of burning and increase the amount of planting spots. In addition, depending on the chip market or co-generation plants, a return could be made on the biomass.

Disadvantages to this type of system are the increased landing sizes and road systems needed to support this operation and the increased expense of yarding. In addition, unstable chip prices make it difficult to predict if the increased utilization could make it pay for itself. The hog fuel and co-generation markets tend to be driven by the price of other existing energy sources.

Intensive utilization on human health effects is basically increased exposure of logging crews to the hazards inherent with logging.

According to Alex Sifford in his 1988 report on Bioenergy Conversion Opportunities, many studies have been done in the Region to determine costs of processing and delivering logging residue to energy users. A Washington study estimated the cost of getting firewood to landings in the forest. It concluded that felling, yarding and decking cost about $16 per green ton (Brown and Bergvall, 1983). Another study done by LeDoux and Adams, 1983, estimated the costs of yarding, loading and hauling residue from a Benton County site to Eugene to be about $49 per green ton. No processing costs were included. In-woods chipping would likely result in lower costs, due to more efficient hauling of the residue. A southern Oregon study determined that it would cost about $21 per green ton to fell, yard, load and haul (unprocessed) residue to a nearby mill (Brown, et al, 1985). The estimated total costs for felling, yarding and chipping hardwoods in the south coast region of Oregon were $43 to $63 per green ton in 1985 dollars (Perry).

[6] D.V. Sandberg, paper presented to the Air Quality Panel at The Bioenergy Seminar, Portland, Oregon, May 10-11, 1984.

III. CHEMICAL (SITE PREPARATION AND RELEASE)

The use of herbicides to control vegetation.

Description: Herbicides may be used in a variety of areas to control competing and unwanted vegetation. All herbicides used must be registered by the U.S. Environmental Protection Agency. Treatments are made within the manufacturers' label restrictions and agency administrative directions. Herbicides are applied with four different techniques.

A. Aerial application, using helicopter or fixed-wing aircraft.

B. Mechanical equipment, using truck-mounted wand or boom sprayers.

C. Backpack equipment, generally a pressurized container with an agitation device.

D. Hand application by injection, daubing cut surfaces, and ground application of granular formulation.

Advantages of herbicide application is the ability to target vegetation growth patterns (periods when the target species are susceptible and the crop species is not), and the low impact to soil surfaces. In addition, aerial applications can be very cost efficient, through treatment of large acreages in a short time period. The other three alternatives have the advantage of being a highly selective treatment.

Disadvantages of herbicide treatment include:

A. Planting can be more expensive amid chemically killed brush.

B. Does not expose mineral soil necessary for natural or artificial seeding.

C. Herbicides may not be acceptable near sensitive areas.

D. Animals move about freely under sprayed brush where they are protected from predators.

E. Increased monitoring for drift and impact on water.

F. The possibility of a chemical spill.

G. Herbicides do little to control wildfire risk, they do not reduce fuel loadings.

Human health effects, in conjunction with the application of herbicides, deal with the amount of exposure the workers have in mixing and applying the herbicide, and for the public in the chance that they might be exposed during a herbicide application. The amount of adverse health effect that either of these two groups could experience would depend upon the toxicity of herbicide, concentration, and length of exposure. Generally, the human health risk is very low when herbicides are properly used.

Chemicals for site preparation and release have not been an alternative that has been available for federal agencies since 1983 due to a district court injunction. This has lead to a much greater dependency on other alternatives.

Costs for herbicide application for 1990 (Hood River County Forestry Department):

A. Aerial - $50/$60/acre

B. Ground (backpack) - $70/acre

IV. MANUAL/HAND LABOR

Description: Creating planting spots by hand, or hand piling slash. In addition, using equipment, such as power saws, to achieve release objectives. Competing brush is cut, allowing the crop tree more space and resources to grow. Hand girdling (removing a band of bark from around the stem) is occasionally done for conifer release.

The advantage of hand methods is their specificity and low impact on the soil surface. Site specific areas can be targeted. In riparian areas, and sites with sensitive plants, hand methods assure that only target species are treated.

The major disadvantages of manual methods are their lower production rates, higher costs, and re-sprouting. In addition, manual methods require extensive human exposure to potentially dangerous working conditions. Manual methods have been very ineffective in the most productive sites and with certain brush species, due to re-sprouting and high costs.

Adverse health effects of manual methods include working on steep slopes with poor footing, in dense or tall brush, and exposure to exhaust and gas vapors. Chain saws are dangerous if used unsafely. Workers also face a greater exposure to the risk of being cut and the exposure to poisonous plants, snakes and insects.

The average costs for single manual treatments have been $206 per acre for site preparation and $166 per acre for conifer release. This varies greatly by specific technique and multiple treatments are sometimes needed. Some typical costs for the different techniques have been: (USDA, Final Environmental Impact Statement, Managing Competing and Unwanted Vegetation).

A. Manual cutting (alder) - $50-$90/acre

B. Manual cutting (tan oak) - $150-$500/acre

C. Mulching (paper) - $70-$235/acre

D. Grubbing - $110-$160/acre

E. Pulling - $40-$200/acre

V. NO TREATMENT

Description: No treatment would consist of not using any of the available alternatives for site preparation after harvest. Units would be harvested and reforested either naturally or by planting.

Advantages to this alternative are lower costs, as long as successful regeneration results. In the eastern part of the State, some sites, are quite suitable for this alternative. This works well in parts of western Oregon also, depending upon the site, the competing brush and the amount of slash.

Disadvantages to this treatment, in a large part of Oregon, are the loss of trees and growth due to increased competition from brush and grasses. Heavy slash accumulations lead to increased wildfire hazards, higher planting costs, increased unfavorable animal and insect habitat.

Table 3 shows the potential impact of the different site preparation alternatives on air, soil, health and wildlife as well as the percent slope and a cost comparison.

TABLE 3

Site Preparation Alternative Evaluation

Site Prep. Method	Air Quality Impacts	Soil Quality Impacts	Max. % Slope	Cost	Health	Wildlife
Prescribed Burning	Mod	Low	Any	Mod	Low	Low
Mechanical for Burning						
Tractor	Mod	Mod	35%	Mod	Low	Low
Excavator	Mod	Mod	50%	Mod	Low	Low
Excavator*	Mod	Low	Any	High	Low	Low
Mechanical Non-Burning						
Tractor	Low	Mod	35%	Low	Low	Low
Excavator	Low	Mod	50%	Mod	Low	Low
Chipper**	Low	Mod	50%	High	Low	Low
Manual	Low	Low	Any	High	Mod	Low
Chemical	Low	Low	Any	Low	Low	Low
Utilization	Low	Low	Any	High	Low	Low

***Walking excavator**
****Tractor-mounted in-unit chipper**

VI. CURRENT USE OF THE ALTERNATIVE METHODS

Currently portions of all four alternatives are being used successfully to meet site preparation and release objectives under the appropriate biological and operational conditions. The exceptions are the walking excavator and co-generation, for reasons already explained.

Seven factors influence choice of site preparation methods:

A. The nature of existing ground cover.

B. Physical site factors.

C. Site preparation requirements.

D. Available manpower and equipment.

E. External constraints.

F. Environmental impacts.

G. Costs.

One or two of these may dominate and dictate a specific choice of method, but all seven should be considered before a treatment is prescribed.

A. Mechanical:

The use of machine piling, mowing, disking, and crushing can be effective on relatively gentle terrain slopes of less than 25 to 35 percent). This method is principally used for site preparation after logging or for site conversion.

Track-mounted excavators are currently in use on slopes of 50 percent or less. The machine is being used to pile, mow and scalp for planting spots. This method is principally used for site preparation after logging.

B. Manual:

Hand felling, girdling, grubbing, pulling, and scalping have proven effective when applied in the appropriate circumstances. For the USFS, manual release methods have become increasingly important since the 1983 U.S. District Court injunction on herbicide use within the Pacific Northwest Region. Manual methods have been most effectively used in moderately severe competition vegetation types.

C. Herbicides:

Herbicides are currently being utilized in reforestation programs statewide. Herbicide need and effectiveness is greatest where competing vegetation is a major factor limiting reforestation. Determining chemical treatment requires consideration of several factors: the most effective herbicide or combination of herbicides, the rate or amount of active ingredient to be applied, season of application and type of equipment to be used.

D. Intensive Utilization:

Currently intensive utilization is being used in some areas where equipment exists for mechanized processing on unit landings. Operations which operate whole tree processors that manufacture logs on the landings are shipping logs down to a 2-inch top. This material is then being processed into chips or hog fuel. Intensive utilization, on a broad scale, is already occurring. The amount of fiber removed from harvest areas is significantly more than it was in the past.

E. Combinations of Methods:

Several combinations of all of the above methods, including burning, are being used to effectively meet silvicultural objectives:

1. Machine piling of logging residues and fuels, followed by burning of the piles.

2. Machine crushing or chaining, followed by broadcast burning.

3. Aerial herbicide use to desiccate or kill vegetation, followed in two to six months by broadcast burning.

4. Hand felling of hardwoods or large woody shrubs, followed by burning.

5. Hand felling and daubing of cut surfaces with systemic herbicides.

6. Hand cutting of large stems and injection of a systemic herbicide for translocation to the root system and aerial parts of the plant.

7. Intensive yarding of logging residue and aerial application of herbicides**.**

Washington State Smoke Management Plan
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APPENDIX 15

Related Laws

I. WASHINGTON FOREST PROTECTION LAWS; RCW 76.04 (Applicable Sections)

BURNING PERMITS

RCW 76.04.205 Burning permits. (1) Except in certain areas designated by the department or as permitted under rules adopted by the department, a person shall have a valid written burning permit obtained from the department to burn:

(a) Any flammable material on any lands under the protection of the department; or

(b) Refuse or waste forest material on forest lands protected by the department.

(2) To be valid a permit must be signed by both the department and the permittee. Conditions may be imposed in the permit for the protection of life, property, or air quality and [the department] may suspend or revoke the permits when conditions warrant. A permit shall be effective only under the conditions and for the period stated therein. Signing of the permit shall indicate the permittee's agreement to and acceptance of the conditions of the permit.

(3) The department may inspect or cause to be inspected the area involved and may issue a burning permit if:

(a) All requirements relating to fire fighting equipment, the work to be done, and precautions to be taken before commencing the burning have been met;

(b) No unreasonable danger will result; and

(c) Burning will be done in compliance with air quality standards established by chapter 70.94 RCW.

(4) The department, authorized employees thereof, or any warden or ranger may refuse, revoke, or postpone the use of permits to burn when necessary for the safety of adjacent property or when necessary in their judgment to prevent air pollution as provided in chapter 70.94 RCW. [1986 c 100 17.]

II. WASHINGTON CLEAN AIR ACT; RCW 70.94 (Applicable Sections)

RCW 70.94.011 Declaration of public policies and purpose. It is declared to be the public policy to preserve, protect, and enhance the air quality for current and future generations. Air is an essential resource that must be protected from harmful levels of pollution. Improving air quality is a matter of statewide concern and is in the public interest. It is the intent of this chapter to secure and maintain levels of air quality that protect human health and safety, including the most sensitive members of the population, to comply with the requirements of the federal clean air act, to prevent injury to plant, animal life, and property, to foster the comfort and convenience of Washington's inhabitants, to promote the economic and social development of the state, and to facilitate the enjoyment of the natural attractions of the state.

It is further the intent of this chapter to protect the public welfare, to preserve visibility, to protect scenic, aesthetic, historic, and cultural values, and to prevent air pollution problems that interfere with the enjoyment of life, property, or natural attractions.

Because of the extent of the air pollution problem the legislature finds it necessary to return areas with poor air quality to levels adequate to protect health and the environment as expeditiously as possible but no later than December 31, 1995. Further, it is the intent of this chapter to prevent any areas of the state with acceptable air quality from reaching air contaminant levels that are not protective of human health and the environment.

The legislature recognizes that air pollution control projects may affect other environmental media. In selecting air pollution control strategies state and local agencies shall support those strategies that lessen the negative environmental impact of the project on all environmental media, including air, water, and land.

The legislature further recognizes that energy efficiency and energy conservation can help to reduce air pollution and shall therefore be considered when making decisions on air pollution control strategies and projects.

It is the policy of the state that the costs of protecting the air resource and operating state and local air pollution control programs shall be shared as equitably as possible among all sources whose emissions cause air pollution.

It is also declared as public policy that regional air pollution control programs are to be encouraged and supported to the extent practicable as essential instruments for the securing and maintenance of appropriate levels of air quality.

To these ends it is the purpose of this chapter to safeguard the public interest through an intensive, progressive, and coordinated statewide program of air pollution prevention and control, to provide for an appropriate distribution of responsibilities, and to encourage coordination and cooperation between the state, regional, and local units of government, to improve cooperation between state and federal government, public and private organizations, and the concerned individual, as well as to provide for the use of all known, available, and reasonable methods to reduce, prevent, and control air pollution.

The legislature recognizes that the problems and effects of air pollution cross political boundaries, are frequently regional or inter-jurisdictional in nature, and are dependent upon the existence of human activity in areas having common topography and weather conditions conducive to the buildup of air contaminants. In addition, the legislature recognizes that air pollution levels are aggravated and compounded by increased population, and its consequences. These changes often result in increasingly serious problems for the public and the environment.

The legislature further recognizes that air emissions from thousands of small individual sources are major contributors to air pollution in many regions of the state. As the population of a region grows, small sources may contribute an increasing proportion of that region's total air emissions. It is declared to be the policy of the state to achieve significant reductions in emissions from those small sources whose aggregate emissions constitute a significant contribution to air pollution in a particular region.

It is the intent of the legislature that air pollution goals be incorporated in the missions and actions of state agencies.

[1991 c 199 102; 1973 1st ex.s. c 193 1; 1969 ex.s. c 168 1; 1967 c 238 1.]

NOTES:

Finding--1991 c 199: "The legislature finds that ambient air pollution is the most serious environmental threat in Washington state. Air pollution causes significant harm to human health; damages the environment, including trees, crops, and animals; causes deterioration of equipment and materials; contributes to water pollution; and degrades the quality of life.

Over three million residents of Washington state live where air pollution levels are considered unhealthful. Of all toxic chemicals released into the environment more than half enter our breathing air. Citizens of Washington state spend hundreds of millions of dollars annually to offset health, environmental, and material damage caused by air pollution. The legislature considers such air pollution levels, costs, and damages to be unacceptable.

It is the intent of this act that the implementation of programs and regulations to control air pollution shall be the primary responsibility of the department of ecology and local air pollution control authorities." [1991 c 199 101.]

Alternative fuel and solar powered vehicles--1991 c 199: "The department of ecology shall contract with Western Washington University for the biennium ending June 30, 1993, for research and development of alternative fuel and solar powered vehicles. A report on the progress of such research shall be presented to the standing environmental committees and the department by January 1, 1994." [1991 c 199 230.]

RCW 70.94.660 Burning permits for abating or prevention of forest fire hazards, management of ecosystems, instruction or silvicultural operations--Issuance. (1) The department of natural resources shall have the responsibility for issuing and regulating burning permits required by it relating to the following activities for the protection of life or property and/or for the public health, safety, and welfare:

(a) Abating a forest fire hazard;
(b) Prevention of a fire hazard;
(c) Instruction of public officials in methods of forest fire fighting;
(d) Any silvicultural operation to improve the forest lands of the state; and
(e) (e) Silvicultural burning used to improve or maintain fire dependent ecosystems for rare plants or animals within state, federal, and private natural area preserves, natural resource conservation areas, parks, and other wildlife areas.

(2) The department of natural resources shall not retain such authority, but it shall be the responsibility of the appropriate fire protection agency for permitting and regulating outdoor burning on lands where the department of natural resources does not have fire protection responsibility.

(3) Permit fees shall be assessed for silvicultural burning under the jurisdiction of the department of natural resources and collected by the department of natural resources as provided for in this section. All fees shall be deposited in the air pollution control account, created in RCW 70.94.015. The legislature shall appropriate to the department of natural resources funds from the air pollution control account to enforce and administer the program under RCW 70.94.665 and 70.94.660, 70.94.670, and 70.94.690. Fees shall be set by rule by the department

of natural resources at the level necessary to cover the costs of the program after receiving recommendations on such fees from the public and the forest fire advisory board established by RCW 76.04.145. [1991 c 199 404; 1971 ex.s. c 232 2.]

RCW 70.94.665 Silvicultural forest burning--Reduce state-wide emissions--Exemption--Monitoring program. (1) The department of natural resources shall administer a program to reduce state-wide emissions from silvicultural forest burning so as to achieve the following minimum objectives:

(a) Twenty percent reduction by December 31, 1994 providing a ceiling for emissions until December 31, 2000; and

(b) Fifty percent reduction by December 31, 2000 providing a ceiling for emissions thereafter.

Reductions shall be calculated from the average annual emissions level from calendar years 1985 to 1989, using the same methodology for both reduction and base year calculations.

(2) The department of natural resources, within twelve months after May 15, 1991, shall develop a plan, based upon the existing smoke management agreement to carry out the programs as described in this section in the most efficient, cost-effective manner possible. The plan shall be developed in consultation with the department of ecology, public and private landowners engaged in silvicultural forest burning, and representatives of the public.

The plan shall recognize the variations in silvicultural forest burning including, but not limited to, a landowner's responsibility to abate an extreme fire hazard under chapter 76.04 RCW and other objectives of burning, including abating and preventing a fire hazard, geographic region, climate, elevation and slope, proximity to populated areas, and diversity of land ownership. The plan shall establish priorities that the department of natural resources shall use to allocate allowable emissions, including but not limited to, silvicultural burning used to improve or maintain fire dependent ecosystems for rare plants or animals within state, federal, and private natural area preserves, natural resource conservation areas, parks, and other wildlife areas. The plan shall also recognize the real costs of the emissions program and recommend equitable fees to cover the costs of the program.

The emission reductions in this section are to apply to all forest lands including those owned and managed by the United States. If the United States does not participate in implementing the plan, the departments of natural resources and ecology shall use all appropriate and available methods or enforcement powers to ensure participation.

The plan shall include a tracking system designed to measure the degree of progress toward the emission reductions goals set in this section. The department of natural resources shall report annually to the department of ecology and the legislature on the status of the plan, emission reductions and progress toward meeting the objectives specified in this section, and the goals of this chapter and chapter 76.04 RCW.

(3) If the December 31, 1994, emission reductions targets in this section are not met, the department of natural resources, in consultation with the department of ecology, shall use its authority granted in this chapter and chapter 76.04 RCW to immediately limit emissions from such burning to the 1994 target levels and limit silvicultural forest burning in subsequent years to achieve equal annual incremental reductions so as to achieve the December 31, 2000, target level. If, as a result of the program established in this section, the emission reductions are met in 1994, but are not met by December 31, 2000, the department of natural resources in consultation with the department of ecology shall immediately limit silvicultural forest burning to reduce emissions from such burning to the December 31, 2000, target level in all subsequent years.

(4) Emissions from silvicultural burning in eastern Washington that is conducted for the purpose of restoring forest health or preventing the additional deterioration of forest

health are exempt from the reduction targets and calculations in this section if the following conditions are met:

(a) The landowner submits a written request to the department identifying the location of the proposed burning and the nature of the forest health problem to be corrected. The request shall include a brief description of alternatives to silvicultural burning and reasons why the landowner believes the alternatives not to be appropriate.

(b) The department determines that the proposed silvicultural burning operation is being conducted to restore forest health or prevent additional deterioration to forest health; meets the requirements of the state smoke management plan to protect public health, visibility, and the environment; and will not be conducted during an air pollution episode or during periods of impaired air quality in the vicinity of the proposed burn.

(c) Upon approval of the request by the department and before burning, the landowner is encouraged to notify the public in the vicinity of the burn of the general location and approximate time of ignition.

(5) The department of ecology may conduct a limited, seasonal ambient air quality monitoring program to measure the effects of forest health burning conducted under subsection (4) of this section. The monitoring program may be developed in consultation with the department of natural resources, private and public forest landowners, academic experts in forest health issues, and the general public. [1995 c 143 § 1; 1991 c 199 § 403.].

RCW 70.94.670 Burning permits for abating or prevention of forest fire hazards, management of ecosystems, instruction or silvicultural operations--Conditions for issuance and use of permits--Air quality standards to be met--Alternate methods to lessen forest debris. The department of natural resources in granting burning permits for fires for the purposes set forth in RCW 70.94.660 shall condition the issuance and use of such permits to comply with air quality standards established by the department of ecology after full consultation with the department of natural resources. Such burning shall not cause the state air quality standards to be exceeded in the ambient air up to two thousand feet above ground level over critical areas designated by the department of ecology, otherwise subject to air pollution from other sources. Air quality standards shall be established and published by the department of ecology which shall also establish a procedure for advising the department of natural resources when and where air contaminant levels exceed or threaten to exceed the ambient air standards over such critical areas. The air quality shall be quantitatively measured by the department of ecology or the appropriate local air pollution control authority at established monitoring stations over such designated areas. Further, such permitted burning shall not cause damage to public health or the environment. All permits issued under this section shall be subject to all applicable fees, permitting, penalty, and enforcement provisions of this chapter. The department of natural resources shall set forth smoke dispersal objectives designed consistent with this section to minimize any air pollution from such burning and the procedures necessary to meet those objectives.

The department of natural resources shall encourage more intense utilization in logging and alternative silviculture practices to reduce the need for burning. The department of natural resources shall, whenever practical, encourage landowners to develop and use alternative acceptable disposal methods subject to the following priorities: (1) Slash production minimization, (2) slash utilization, (3) non-burning disposal, (4) silvicultural burning. Such alternative methods shall be evaluated as to the relative impact on air, water, and land pollution, public health, and their financial feasibility.

The department of natural resources shall not issue burning permits and shall revoke previously issued permits at any time in any area where the department of ecology or local board

has declared a stage of impaired air quality as defined in RCW 70.94.473. [1991 c 199 405; 1971 ex.s. c 232 3.]

NOTES:

Finding--1991 c 199: See note following RCW 70.94.011.

RCW 70.94.690 Cooperation between department of natural resources and state, local, or regional air pollution authorities--Withholding of permits. In the regulation of outdoor burning not included in RCW 70.94.660 requiring permits from the department of natural resources, said department and the state, local, or regional air pollution control authorities will cooperate in regulating such burning so as to minimize insofar as possible duplicate inspections and separate permits while still accomplishing the objectives and responsibilities of the respective agencies. The department of natural resources shall include any local authority's burning regulations with permits issued where applicable pursuant to RCW 70.94.740* through 70.94.775. The department shall develop agreements with all local authorities to coordinate regulations.

Permits shall be withheld by the department of natural resources when so requested by the department of ecology if a forecast, alert, warning, or emergency condition exists as defined in the episode criteria of the department of ecology. [1991 c 199 406; 1971 ex.s. c 232 5.]

NOTES:

*Reviser's note: RCW 70.94.740 was repealed by 1991 c 199 718.

Finding--1991 c 199: See note following RCW 70.94.011.

RCW 70.94.700 Rules and regulations. The department of natural resources and the department of ecology may adopt rules and regulations necessary to implement their respective responsibilities under the provisions of RCW 70.94.650 through 70.94.700. [1971 ex.s. c 232 6.]

RCW 70.94.743 Outdoor burning--Areas where prohibited--Use for management of storm or flood-related debris--Silvicultural burning.

(1) Consistent with the policy of the state to reduce outdoor burning to the greatest extent practical:

(a) Outdoor burning shall not be allowed in any area of the state where federal or state ambient air quality standards are exceeded for pollutants emitted by outdoor burning.

(b) Outdoor burning shall not be allowed in any urban growth area as defined by RCW 36.70A.030, or any city of the state having a population greater than ten thousand people if such cities are threatened to exceed state or federal air quality standards, and alternative disposal practices consistent with good solid waste management are reasonably available or practices eliminating production of organic refuse are reasonably available. In no event shall such burning be allowed after December 31, 2000.

(c) Notwithstanding any other provision of this section, outdoor burning may be allowed for the exclusive purpose of managing storm or flood-related debris. The decision to allow burning shall be made by the entity with permitting jurisdiction as determined under RCW 70.94.660 or 70.94.755. If outdoor burning is allowed in areas subject to (a) or (b) of this subsection, a permit shall be required, and a fee may be collected to cover the expenses of administering and enforcing the permit. All conditions and restrictions pursuant to RCW

70.94.750(1) and 70.94.775 apply to outdoor burning allowed under this section.

(2) "Outdoor burning" means the combustion of material of any type in an open fire or in an outdoor container without providing for the control of combustion or the control of emissions from the combustion.

(3) This section shall not apply to silvicultural burning used to improve or maintain fire dependent ecosystems for rare plants or animals within state, federal, and private natural area preserves, natural resource conservation areas, parks, and other wildlife areas. [1997 c 225 § 1; 1991 c 199 § 402.]

NOTES:

Finding--1991 c 199: See note following RCW 70.94.011.

RCW 70.94.745 Limited outdoor burning--Program--Exceptions.

(1) It shall be the responsibility and duty of the department of natural resources, department of ecology, department of agriculture, fire districts, and local air pollution control authorities to establish, through regulations, ordinances, or policy, a limited burning permit program.

(2) The permit program shall apply to residential and land clearing burning in the following areas:

(a) In the nonurban areas of any county with an unincorporated population of greater than fifty thousand; and

(b) In any city and urban growth area that is not otherwise prohibited from burning pursuant to RCW 70.94.743.

(3) The permit program shall apply only to land clearing burning in the nonurban areas of any county with an unincorporated population of less than fifty thousand.

(4) The permit program may be limited to a general permit by rule, or by verbal, written, or electronic approval by the permitting entity.

(5) Notwithstanding any other provision of this section, neither a permit nor the payment of a fee shall be required for outdoor burning for the purpose of disposal of tumbleweeds blown by wind. Such burning shall not be conducted during an air pollution episode or any stage of impaired air quality declared under *RCW 70.94.714. This subsection (5) shall only apply within counties with a population less than two hundred fifty thousand.

(6) Burning shall be prohibited in an area when an alternate technology or method of disposing of the organic refuse is available, reasonably economical, and less harmful to the environment. It is the policy of this state to foster and encourage development of alternate methods or technology for disposing of or reducing the amount of organic refuse.

(7) Incidental agricultural burning must be allowed without applying for any permit and without the payment of any fee if:

(a) The burning is incidental to commercial agricultural activities;

(b) The operator notifies the local fire department within the area where the burning is to be conducted;

(c) The burning does not occur during an air pollution episode or any stage of impaired air quality declared under RCW 70.94.715; and

(d) Only the following items are burned:

(i) Orchard prunings;

(ii) Organic debris along fence lines **or irrigation or drainage ditches; or**

(iii) Organic debris blown by wind.

(8) As used in this section, "nonurban areas" are unincorporated areas within a county that is not designated as an urban growth area under chapter 36.70A RCW.

(9) Nothing in this section shall require fire districts to enforce air quality requirements related to outdoor burning, unless the fire district enters into an agreement with the department of ecology, department of natural resources, a local air pollution control authority, or other appropriate entity to provide such enforcement. [1995 c 206 § 1; 1991 c 199 § 401; 1972 ex.s. c 136§ 2.]

RCW 70.94.750 Limited outdoor burning--Permits issued by political subdivisions--Types of fires permitted. The following outdoor fires described in this section may be burned subject to the provisions of this chapter and also subject to city ordinances, county resolutions, rules of fire districts and laws, and rules enforced by the department of natural resources if a permit has been issued by a fire protection agency, county, or conservation district:

(1) Fires consisting of leaves, clippings, prunings and other yard and gardening refuse originating on lands immediately adjacent and in close proximity to a human dwelling and burned on such lands by the property owner or his or her designee.

(2) Fires consisting of residue of a natural character such as trees, stumps, shrubbery or other natural vegetation arising from land clearing projects or agricultural pursuits for pest or disease control; provided the fires described in this subsection may be prohibited in those areas having a general population density of one thousand or more persons per square mile. [1991 c 199 412; 1972 ex.s. c 136 3.]

NOTES:

Finding--1991 c 199: See note following RCW 70.94.011.

RCW 70.94.775 Outdoor burning--Fires prohibited--Exceptions. No person shall cause or allow any outdoor fire:

(1) Containing garbage, dead animals, asphalt, petroleum products, paints, rubber products, plastics, or any substance other than natural vegetation that normally emits dense smoke or obnoxious odors. Agricultural heating devices that otherwise meet the requirements of this chapter shall not be considered outdoor fires under this section;

(2) During a forecast, alert, warning or emergency condition as defined in RCW 70.94.715 or impaired air quality condition as defined in RCW 70.94.473. [1991 c 199 410; 1974 ex.s. c 164 1; 1973 2nd ex.s. c 11 1; 1973 1st ex.s. c 193 9.]

NOTES:

Finding--1991 c 199: See note following RCW 70.94.011.

III. DNR BURNING PERMIT REGULATIONS; WAC 332-24 (ENTIRE CHAPTER)

WAC 332-24-201 BURNING PERMIT PROGRAM--REQUIREMENTS AND EXCEPTIONS. Under authority granted in RCW 76.04.015 and 76.04.205, the following regulation is hereby promulgated:

(1) The department is responsible, by law, for the granting of burning permits for burning on lands it protects; and

(2) The department administers the protection of air quality as provided in chapter 70.94 RCW resulting from burning on lands under its protection; and

(3) The department has determined that the effects of such burning on life, property and air quality are of year-round effect; therefore

(4) Throughout the year, outdoor fire is prohibited on lands protected by the department where forest protection assessment is being, or is subject to being, assessed unless:

(a) A written burning permit is obtained from the department and the requirements of WAC 332-24-205 and 332-24-221 are followed; or

(b) Burning meets the regulations outlined in WAC 332-24-205 and 332-24-211.

(5) This chapter applies to all burning on lands protected by the department. It does not apply to agricultural burning as defined in WAC 173-425-030(1) nor to open burning as defined in WAC 173-425-030(2).

WAC 332-24-205 General rules--minimum requirements for all burning. The following rules apply to all burning regulated by the department.

(1) The department reserves the right to restrict, regulate, refuse, revoke or postpone outdoor fires under RCW 76.04.205 and 76.04.315, and chapter 70.94 RCW due to adverse fire weather or to prevent restriction of visibility, excessive air pollution or a nuisance.

(2) Burning shall not be allowed within non-attainment areas of the state as established by Washington department of ecology for particulate matter ten microns or less or carbon monoxide, except for:

(a) Fires for improving and maintaining fire dependent ecosystems; or

(b) Fires for training wildland fire fighters; or

(c) Fires set for a defined research project; or

(d) Military training exercises; or

(e) Where exempted by local or state air pollution control agencies.

(3) Burning shall not be allowed inside urban growth areas as designated under growth management plans, or in cities of greater than ten thousand population as follows:

(a) In urban growth areas where reasonable alternatives exist.

(b) In cities with a population of ten thousand or more as established by the office of financial management.

(i) That exceed or threaten to exceed federal or state ambient air quality standards; and

(ii) Where reasonable alternatives to outdoor burning exist, in accordance with WAC 173-425-090.

(c) After December 31, 2000, burning shall not be allowed in urban growth areas or cities with a population of ten thousand or more.

(4) No fires shall be ignited when:

(a) The department of ecology has declared an air pollution episode for the geographic area pursuant to chapter 173-435 WAC; or

(b) The department of ecology or a local air pollution control authority has declared impaired air quality for the geographic area in which the burning is to be done.

(5) A person responsible for a burn at the time an episode or impaired air quality is called pursuant to chapter 173-425 WAC, shall extinguish the fire by:

(a) Withholding fuel from the burn;

(b) Allowing the fire to burn down; and

(c) Aggressively putting out the fire until there is no visible smoke, unless otherwise allowed by the department.

(6) Prior to lighting, the person doing the burning must telephone the department, and obtain any special instructions for the day and location of the proposed burn. Those instructions thereupon become part of the conditions of burning.

(7) The fire must not include rubber products, plastic products, asphalt, garbage, dead animals, petroleum products, paints, or any similar prohibited materials that emit dense smoke or create offensive odors when burned, pursuant to RCW 70.94.775(1).

(8) If the fire creates a nuisance from smoke or flying ash, it must be extinguished. For purposes of this section, a nuisance exists when emissions from any open fire cause physical discomfort or health problems to people residing in the vicinity of the burning or physical damage to property.

(9) Burning within the department's fire protection areas shall not:

(a) Cause visibility to be obscured on public roads and highways by the smoke from such fires; or

(b) Endanger life or property through negligent spread of fire or pollutants.

(10) A person capable of extinguishing the fire must attend the fire at all times and the fire must be completely extinguished before being left unattended.

(11) No fires are to be within fifty feet of structures, or within five hundred feet of forest slash without a written burning permit.

(12) The landowner or landowner's designated representative's written permission must be obtained before kindling a fire on the land of another.

(13) The department reserves the authority to provide waivers, exceptions, and/or to impose additional requirements through the use of written burning permits and the smoke management plan.

WAC 332-24-211 Specific rules for small fires not requiring a written burning permit. In addition to WAC 332-24-205, the following rules shall apply to burning regulated by the department that does not require a written burning permit. A written burning permit is not required from the department under the following conditions:

(1) In certain geographic areas of the state as designated by the department in subsections (3) of this section and when the requirements of subsections (4), (5), and (6) of this section are met; or

(2) When the fire is:

(a) Contained within a campfire pit, approved by the department, located in a state, county, municipal, or other campground;

(b) Contained within a camp stove or barbecue;

(c) A hand-built pile no larger than four feet in diameter that is being used exclusively for recreational purposes; and

(d) Situated on bare soil, gravel bars, beaches, green field, or other similar areas free of flammable material for a sufficient distance adequate to prevent the escape of fires.

(3) A fire that does not require a written permit has established size limitations based on time of year and the county within which the burning occurs.

(a) From July 1 to October 15 individual pile size in all counties shall be limited to no larger than four feet, except pile size in Clallam and Jefferson counties is limited to ten feet.

(b) From October 16 through June 30 individual pile size in all counties is limited to ten feet; except pile size is limited to four feet in Island, King, Kitsap, Mason, Pierce, San Juan, and Spokane counties.

(4) A serviceable shovel and a minimum of five gallons of water must be within the immediate vicinity of the fire. A bucket is acceptable if the outdoor fire is adjacent to an

accessible body of water. A charged garden hose or other adequate water supply may be substituted for the five gallon water requirement.

(5) Only one pile may be burned at any one time and each pile must be extinguished before lighting another.

(6) Burning must be done during periods of calm to very light winds. Burning when wind will scatter loose flammable materials, such as dry leaves and clippings, is prohibited.

WAC 332-24-217 Burning permit requirements--penalty. Failure to comply with the rules in chapter 332-24 WAC voids permission to burn. Any person burning without complying with chapter 332-24 WAC is in violation of RCW 76.04.205 and chapter 70.94 RCW. Convictions or bail forfeitures in connection with illegal burning under chapter 332-24 WAC may result in refusal to issue further permits for a two-year period from the date of the illegal burning. In addition to any other fines and penalties that may be imposed, the department may charge and recover costs from the person responsible for any response to control or extinguish an illegal fire caused in part or in whole by negligent acts or omissions.

WAC 332-24-221 Specific rules for burning that requires a written burning permit. Persons not able to meet the requirements of WAC 332-24-205 and 332-24-211 must apply for a written burning permit through the department. In addition to the rules outlined in WAC 332-24-205, the following are additional requirements for written permits:

(1) Written burning permits will be in effect for one year from the validation date, unless suspended or revoked.

(2) Fees for written burning permits will be charged and collected pursuant to chapter 70.94 RCW and shall be twenty-four dollars and seventy-five cents for under one hundred tons of consumable debris; and for burns one hundred tons of consumable debris and greater as follows:

Consumable Debris	Fee Schedule
100 - 500 tons	**$ 123**
501 - 1,000 tons	**379**
1,001 - 1,500 tons	**631**
1,501 - 2,000 tons	**885**
2,001 - 2,500 tons	**1,138**
2,501 - 3,000 tons	**1,392**
3,001 - 3,500 tons	**1,643**
3,501 - 4,000 tons	**1,897**
4,001 - 4,500 tons	**2,151**
4,501 - 5,000 tons	**2,404**
5,001 - 5,500 tons	**2,658**
5,501 - 6,000 tons	**2,911**
6,001 - 6,500 tons	**3,166**
6,501 - 7,000 tons	**3,419**
7,001 - 7,500 tons	**3,673**
7,501 - 8,000 tons	**3,936**
8,001 - 8,500 tons	**4,180**
8,501 - 9,000 tons	**4,433**
9,001 - 9,500 tons	**4,688**
9,501 - 10,000 tons	**4,939**
10,001 + tons	**5,193**

For purposes of this section, consumable debris is the amount of debris that the department determines will be consumed by the proposed burning.

(3) Written burning permits are not considered valid unless all of the following conditions apply:

(a) The written permit has been signed by the applicant agreeing to follow all requirements of chapter 332-24 WAC, the smoke management plan in effect at the time of the burning, and any additional terms and conditions specified by the department in writing; and

(b) The required permit fee has been secured or paid according to approved department procedures; and

(c) The person doing the burning has the permit in possession while burning and is complying with all terms and conditions of such permit, the smoke management plan in effect at the time of the burning, and all applicable portions of chapter 332-24 WAC.

(4) Permits are written only for the burn site and fuel quantity that is presented at the time of the inspection. Addition of fuel, or changing the burn site after the site inspection has been made, is prohibited unless a new inspection is made and an added permit fee is paid, if required**.**

WAC 332-24-271 Fires for improving and maintaining fire dependent ecosystems.

(1) All burning to improve and maintain fire dependent ecosystems within Conservation Areas and Natural Area Preserves shall be accomplished under a burning plan that has been approved by the department's land and water conservation division and fire control division managers. The burning plan must be a part of a total management plan approved by the land and water conservation division.

(2) Burning for this purpose may be allowed inside non-attainment areas, or urban growth areas.

(3) Burning for this purpose shall not be allowed during periods of air pollution episodes or air quality impairment called under chapter 173-425 WAC.

IV. DEPARTMENT OF ECOLOGY BURNING REGULATIONS; WAC 173-425 (ENTIRE CHAPTER)

WAC 173-425-010 Purpose. This chapter promulgated under chapter 70.94 RCW, the Washington Clean Air Act, authorizes the department of ecology to implement the provisions of that act. This rule establishes controls for open burning in the state in order to:

(1) Reduce open burning to the greatest extent practical by eliminating it in:

(a) Areas that exceed ambient air quality standards for PM-10 and/or carbon monoxide; and

(b) Urban growth areas or cities with a population of 10,000 or more by December 31, 2000;

(2) For areas where open burning is allowed, establish a limited burning program, including procedures by which open burning may be conducted;

(3) Encourage the development and use of alternate methods of debris disposal.

WAC 173-425-020 Applicability. (1) No outdoor burning shall occur during a declared period of impaired air quality.

(2) Except as described in subsection (1) of this section and WAC 173-425-050, this chapter applies to all forms of outdoor burning in the state except:

(a) Silvicultural burning (governed by chapter 332-24 WAC).

(b) Agricultural burning (governed by chapter 173-430 WAC).

(c) Recreational fires as defined in WAC 173-425-030(12).

(d) Ceremonial fires as defined in WAC 173-425-030(2).

(e) Burning to improve and maintain fire dependent ecosystems (pursuant to chapter 332-24 WAC).

(3) A local air authority, fire protection authority, county, or conservation district may enforce its own controls that are stricter than those set forth in this chapter.

WAC 173-425-030 Definitions. The definitions of terms contained in chapter 173-400 WAC are incorporated by reference. Unless a different meaning is clearly required by context, the following words and phrases as used in this chapter shall have the following meanings:

(1) "Agricultural burning" means burning of vegetative debris from an agricultural operation necessary for disease or pest control, necessary for crop propagation and/or crop rotation, or where identified as a best management practice by the agricultural burning practices and research task force established in RCW 70.94.650 or other authoritative source on agricultural practices.

(2) "Ceremonial fire" means a fire associated with a Native American ceremony or ritual.

(3) "Department" means department of ecology.

(4) "Episode" means a period when a forecast, alert, warning, or emergency air pollution stage is declared, as stated in chapter 173-435 WAC.

(5) "Impaired air quality" means a condition declared by the department or a local air authority in accordance with the following criteria:

(a) Meteorological conditions are conducive to an accumulation of air contamination concurrent with:

(i) Particulate that is ten micron and smaller in diameter (PM-10) at or above an ambient level of seventy-five micrograms per cubic meter measured on a twenty-four-hour average; or

(ii) Carbon monoxide at an ambient level of eight parts of contaminant per million parts of air by volume (ppm) measured on an eight-hour average.

(b) Air quality that threatens to exceed other limits established by the department or a local air authority.

(6) "Local air authority" means an air pollution control authority activated pursuant to chapter 70.94 RCW that has jurisdiction over the subject source.

(7) "Nonattainment area" means a clearly delineated geographic area which has been designated by the Environmental Protection Agency and promulgated as exceeding a national ambient air quality standard or standards for one or more of the criteria pollutants, which includes carbon monoxide, fine particulate matter (PM-10), sulfur dioxide, ozone, and nitrogen dioxide.

(8) "Nuisance" means an emission of smoke or other emissions from any open fire that unreasonably interferes with the use and enjoyment of the property deposited on.

(9) "Open burning" means all forms of outdoor burning except those listed as exempt in WAC 173-425-020.

(10) "Outdoor burning" means the combustion of material of any type in an open fire or in an outdoor container without providing for the control of combustion or the control of emissions from the combustion.

(11) "Reasonable alternatives" means disposal alternatives to open burning that cost less than eight dollars fifty cents per cubic yard. After July 1993, this amount shall be adjusted periodically by department policy.

(12) "Recreational fire" means barbecues and campfires, using charcoal, natural gas, propane, or natural wood which occur in designated areas or on private property. Fires used for debris disposal purposes are not considered recreational fires.

(13) "Silvicultural burning" means burning on any land the department of natural resources protects per RCW 70.94.030(13), 70.94.660, 70.94.690, and pursuant to chapter 76.04 RCW.

(14) "Urban growth area" means an area defined by RCW 36.70A.030.

WAC 173-425-040 Prohibited materials.

(1) Except as provided in WAC 173-425-020(2), the following materials shall not be burned in any outdoor fire: Garbage, dead animals, asphalt, petroleum products, paints, rubber products, plastics, paper (other than what is necessary to start a fire), cardboard, treated wood, construction debris, metal or any substance (other than natural vegetation) which when burned releases toxic emission, dense smoke, or odors.

(2) Prohibited materials may be burned in certain circumstances:

(a) Diseased animals and infested material. When ordered by a duly authorized health officer and authorized by the department or local air authority, diseased animals and other infested material may be burned, as required, to keep the infestation from spreading.

(b) Dangerous material. When ordered by a fire protection authority and when authorized by the department or local air authority, fires to dispose of materials presenting a danger to life, property, or public welfare may be burned, if no approved practical alternate method of disposal is available.

WAC 173-425-050 Curtailment during episodes or impaired air quality.

(1) No outdoor fire shall be ignited:

(a) Whenever the department declares an air pollution episode for the geographical area pursuant to chapter 173-435 WAC; or

(b) Whenever the department or a local air authority declares impaired air quality for the geographical area.

(2) A person responsible for an outdoor fire at the time an episode or impaired air quality is declared shall extinguish that fire. Outdoor burning conducted under the auspices of the department of natural resources for the purpose of burning forest slash pursuant to RCW 70.94.660 through 70.94.670 shall be extinguished by withholding new fuel and allowing the fire to burn down.

(3) Smoke visible from all types of outdoor burning, except silvicultural burning, after a time period of three hours has elapsed from the time of declaration of the episode or impaired air quality shall constitute prima facie evidence of unlawful outdoor burning.

(4) For department of natural resource silvicultural burning, smoke visible from outdoor burning after a time period of ten hours has elapsed from the time of declaration of the episode or impaired air quality shall constitute prima facie evidence of unlawful outdoor burning.

WAC 173-425-060 Open burning program for the state.

(1) General requirements:

(a) All burning requires a permit as covered in WAC 173-425-070.

(b) Permits shall not be issued, and thus open burning is not allowed, in areas where reasonable alternatives are available. Within ninety days of the effective date, the department shall develop uniform procedures for determining costs of alternatives to open burning.

(c) A fire protection authority may declare a fire hazard in areas where burning is banned and in areas where burning is allowed. If open burning is determined the most appropriate manner to abate the fire hazard, the request must be reviewed and permitted by the local air authority. Permits issued under this section shall provide that:

(i) Prohibited material shall not be burned in any fire;

(ii) No open burning shall be done during a declared period of impaired air quality;

(iii) No reasonable alternative is available.

(d) No open burning shall be allowed in areas that exceed federal or state ambient air quality standards. Such areas shall be defined as carbon monoxide and/or PM-10 nonattainment area, unless otherwise determined pursuant to subsection (2)(a) of this section.

(2) Additional requirements for nonattainment areas.

(a) Phase-out approach. A local air authority may petition the department to use a phase-out approach in portions of a federally designated nonattainment area for carbon monoxide and/or PM-10. The phase-out approach will focus on how to achieve the Washington Clean Air Act goals and eliminate burning in areas that exceed the standards. The department will review and determine if the petition should be approved. The department may partially approve petitions or approve petitions with conditions based on consideration of the following factors:

(i) Population and population density.

(ii) The ability of the air quality in the region to support open burning based upon geographical and meteorological conditions.

(iii) The presence of a permitting program.

(iv) The extent to which reasonable alternatives to open burning are being developed through solid waste management plans and the schedule for the availability of such reasonable alternatives.

(v) Other factors deemed appropriate by the local air authorities.

(b) Petition evaluation. The petition to use a phase-out approach is due to the department no later than one month after the effective date of this rule. A ban is not effective in areas identified in the petition until after the department makes a ruling on the petition. Upon receiving the petition, the department shall review and make a determination within thirty days. For all federally designated nonattainment areas, open burning shall be banned by the applicable attainment date.

(c) Permits. The department or local air authority may issue permits in banned areas for the following activities:

(i) Fire fighting instruction. Local air authorities or the department may issue permits for fire training fires, pursuant to guidelines and rules of the department of ecology.

(ii) Specific forms. The department or the local air authorities may permit, with conditions, fires set that are part of a defined research project, weed abatement, and smoke training as part of a military training exercise.

(d) Responding to open burning calls. Each affected county shall identify a fire marshal or other appropriate county official for field response and to document open burning complaints or violations using appropriate field notices. In areas where the county has no jurisdiction, the department or the local air authorities will negotiate with the appropriate local agency on field response.

(3) Additional requirements for urban growth areas and cities with a population of ten thousand or more.

(a) Open burning will be banned when reasonable alternatives are available, no later than the end of the year 2000.

(b) Until open burning is banned, it is allowed subject to the permitting provisions of this chapter.

(c) When open burning is banned, the provisions in subsection (2) of this section apply.

WAC 173-425-070 Open burning permit requirements.

(1) Permit program. For areas where burning is allowed, the department, local air authorities, fire protection authorities, conservation districts, or counties may issue permits. Those issuing permits are responsible for field response to open burning complaints. Within ninety days of the effective date, the department shall develop minimum standards for a field response program, which addresses training, staffing, funding, and any other elements deemed appropriate by the department.

(2) Permit program development and assistance.

(a) The department shall provide assistance for implementing a permitting program, including minimum standards which address training, staffing, funding, and any other elements deemed appropriate by the department.

(b) The department shall develop a model permit program and provide guidance on starting and implementing permit programs.

(c) In selecting a permit program, the options range from the minimum - a general rule burn, as described in subsection (5) of this section - to a written permit. A permit program must be in place eight months after the department issues guidelines. If at that time no agreement is reached, the area becomes a no-burn area and falls under the restrictions of WAC 173-425-060(2). The department will conduct a joint public hearing with the conservation districts, local air authorities, counties, and fire districts. The purpose of the hearing is to inform the public that no agreement has been reached.

(d) The department or the local air authorities shall coordinate with the agencies listed in subsection (1) of this section to determine the type of permitting program appropriate for the area.

(3) Fees. The department or the local air authority may charge a fee to cover the administrative cost of a permit program. Fire districts, counties, and conservation districts issuing open burning permits may collect a fee to cover administrative costs. (RCW 70.94.780)

(4) Additional restrictions. The local air authorities and the department pay restrict conditions for burning under this section. Burning conditions may include, but are not limited to, restricting burning in sensitive areas per chapter 173-440 WAC, restricting the time period for burning, restricting permissible hours of burning, imposing requirements for good combustion practice, and restricting burning to specified weather conditions.

(5) General rule burn permits. For areas of the state where burning is allowed, agencies listed in subsection (1) of this section may use a general permit by rule. This section provides a minimum (general rule burn) permit. Persons not able to meet all of the requirements (a) through (I) of this subsection must apply for and receive a written permit. General rule burn permits under this section may be used for the following number of days per year: 1992-1995 - twenty-one days/year; 1995-1998 - fourteen days/year; 1998-2000 - seven days/year; after 2000 - seven days/year. Failure to comply with all the requirements of (a) through (I) of this subsection voids the general rule burn permit and the person burning is subject to the penalty provisions of WAC 173-425-100. A person burning under this section must follow these requirements and any additional restrictions, including those established by cities, counties, or fire protection authorities:

(a) The fire must not include prohibited materials listed in WAC 173-425-040, except what paper is necessary to start the fire.

(b) A person capable of extinguishing the fire must attend it at all times and the fire must be extinguished before leaving it.

(c) No fires are to be within fifty feet of structures.

(d) The pile must not be larger than four feet by four feet by three feet.

(e) Only one pile at a time may be burned, and each pile must be extinguished before lighting another.

(f) No outdoor fire is permitted in or within five hundred feet of forest slash without a written burning permit.

(g) Either the designated permitting authority must be called to confirm burning conditions for each day or current information on burning conditions must be obtained from another designated source.

(h) If the fire creates a nuisance, it must be extinguished.

(I) Permission from a landowner, or owner's designated representative, must be obtained before starting an open fire.

WAC 173-425-080 Violations.

(1) The local air authority or department may issue a notice of violation to the person responsible for the fire under any of the following:

(a) Conditions of a permit issued under this chapter are violated;

(b) Any open fire is ignited where, under this chapter, such fires are prohibited or where a permit is required and has not been obtained;

(c) Prohibited materials are burned in an open fire;

(d) Any open fire is ignited when a condition of impaired air quality or air pollution episode stage is declared;

(e) Any ignited open fire that is not extinguished when a condition of impaired air quality or air pollution episode is declared;

(f) The fire causes emissions detrimental to health;

(g) The fire causes emissions that unreasonably interfere with property use and enjoyment.

(2) A fire protection authority called to respond to, control, or extinguish an illegal or out-of-control fire may charge and recover from the person responsible for the fire the costs of its response and control action.

WAC 173-425-090 Local air authority may issue variance. Local air authorities may adopt variance procedures in their rules. Variance procedures properly adopted comply with this regulation and satisfy the requirement of department review required by RCW 70.94.181. The department, at its discretion, may review variance petitions.

WAC 173-425-100 Penalties. Any violation of this chapter may be subject to any penalty or other remedy authorized in chapter 70.94 RCW.

WAC 173-425-110 Severability. The provisions of this regulation are severable. If any provision is held invalid, the application of such provision to other circumstances and the remainder of the regulation shall not be affected.

Washington State Smoke Management Plan
(Revised 1995)

APPENDIX 16

Procedure for Exempting Eastside Forest Health Burns From the Requirement for Emission Reduction

Nearly one hundred years of fire suppression has had unintended consequences for eastern Washington forests. Natural low intensity ground fires that once occurred at 5- to 15-year intervals on drier sites have been effectively excluded from the ecosystem. These fires kept forest fuel levels low and favored open stands of fire-resistant seral species like ponderosa pine and larch over more shade tolerant climax species like Douglas fir and grand fir. This has resulted in a large scale conversion of eastern Washington forests to dense stands of trees that are not fire-resistant and are highly susceptible to catastrophic loss by insects, disease and wildfire.

The Washington Legislature has recognized that fire must be reintroduced into these areas to reduce the risk of catastrophic loss over the long term. In 1995, the Legislature amended the Clean Air Act to exempt "emissions from silvicultural burning in eastern Washington that is conducted for the purpose of restoring forest health or preventing the additional deterioration of forest health" from the reduction targets of the Clean Air Act. The Legislature clearly does not want the emissions ceiling of the Clean Air Act to be an obstacle to restoring forest health.

The following procedures describe:

How to identify burning which may qualify for exemption from the emission reduction targets for forest health reasons.

How to request an exemption from the emission reduction targets for a burn.

The process DNR Regions will use to review requests for exemption from the emissions reduction targets.

I. FOREST HEALTH CONDITIONS WHICH MAY QUALIFY FOR EXEMPTION

A. Species Composition - Control species composition to favor the creation and maintenance of stands of fire-resistant seral tree species over climax species.

B. Stand Density - Control of stand density to favor more open fire-resistant and healthy stands over dense, overstocked stands subject to drought stress, insect and disease infestation and high intensity fire.

C. Natural Fuels Build-Up - Control of fuels build-up due to natural processes and not a direct result of management activities.

D. Insect and Disease - Control or prevention of insect or disease outbreaks.

E. Restore Natural Processes - Correct the interruption of natural ecological process caused by the exclusion of fire in fire-dependent ecosystems**.**

II. TYPES OF BURNING QUALIFYING FOR EXEMPTION

A. Underburning.

B. Prescribed stand replacement fire not directly associated with a timber harvest.

C. Burning conducted as part of a project designed for forest health and not primarily as a commercial activity.

D. Burning of piled ponderosa pine slash created between January and June to prevent bark beetle outbreaks when no alternatives are available.

III. ALTERNATIVES TO FOREST HEALTH BURNING

Fire is not the only appropriate method of restoring forest health in every situation. Often, stands are so dense and fuel loads are so high that fire is not an option.

Biomass removal instead of, or in combination with burning are effective in decreasing smoke emissions by reducing fuel loading and decreasing the need for burning.

Mechanical treatments such as thinning reduce the need for burning and allow for better control of emissions when burning is used.

Timing of harvest to avoid creating concentrations of ponderosa pine slash during January through June is effective in preventing bark beetle outbreaks.

Alternatives to burning provide opportunities for improving forest health by reducing fuel loading and creating opportunities to reintroduce fire into the ecosystem.

IV. SUBMITTING REQUESTS FOR EXEMPTION

Requests for exemption are voluntary. No landowner will be required to request an exemption as a condition of granting a burn permit. Disapproval of a request for exemption will not invalidate a burn permit.

A. The request for exemption shall consist of a written statement from the landowner covering the following elements:

1. Legal description of the proposed burn.

2. A description of the health situation, forest health objectives and treatments schedule.

3. A brief description of the alternatives to silvicultural burning that could achieve the desired objective.

4. Reasons why the landowner does not believe alternatives to burning are appropriate in this situation.

Requests for exemption should be submitted with the burning permit application. Requests for exemption will not be accepted after burning is completed.

V. REVIEW AND APPROVAL OF REQUESTS BY DNR

A. General Instructions

The DNR Region will:

1. Review all private and federal requests for exemption. The request approval will be based on the DNR's determination that the burning is being conducted to restore forest health or prevent additional deterioration to forest health (according to guidelines).

2. Determine if the proposed burning qualifies as a forest health burn. Generally, requests for exemption should not be approved if:

(a) the project will burn primarily fuels created by a recent commercial timber harvest, even if the burning will correct a forest health condition listed in section I;

(b) the burn is being conducted for site preparation;

(c) the burn is being conducted to abate an extreme fire hazard as defined in WAC 332-24-650; or

(d) The burn is conducted primarily to enhance wildlife habitat with no corresponding forest health benefit.

These are all valid reasons to burn. They are not primarily to restore forest health or prevent additional deterioration to forest health and are not entitled to the exemption.

The burn permit will be evaluated separately from the request for exemption. Exempted burns must meet all the requirements of the Smoke Management Plan to protect public health, visibility and the environment. The approval of the burn permit will not depend on approval of the request for exemption.

3. Notify the landowner of the approval or disapproval of the request for exemption.

4. Develop a filing system for exemption requests and a method for referencing requests for exemption to burn plans.

5. Assure that the data reporting procedures described in Appendix 2 are followed and that the burn is correctly coded as a forest health exemption burn.

6. Conduct an audit of a representative sample of federal forest health burning exemption requests.

B. Specific Instructions for U.S. Forest Service Burns

1. Prescribed fire projects funded by a majority of BD funds will not be exempt from the emissions cap.

Note: BD funds are funds withheld from timber sale receipts to treat fuels created by harvest activities.

2. The exemption will be determined through planning documents that will indicate forest health exemptions.

3. The U.S. Forest Service will indicate the projects that are exempt through the current SMS data input system. If the project meets the guidelines for exempt status, a forest health burning designation would be indicated as the “reason for burning” in the Pre-Burn Data.

4. Projects designated for exempt status may be chosen at random by DNR for validation of exempt status. The U.S. Forest Service will be requested to provide the documentation that indicated the reason for the designation.

C. Audit

Burning conducted by federal landowners may not receive on site inspections by DNR before burning. A representative sample of federal burns requesting the exemption will be audited to assure compliance with these procedures. The audit will include the following elements:

Review of the request for exemption and any supporting documents for conformity with these procedures;

Site inspection to determine that the identified health problem exists and that burning will improve forest health or prevent additional deterioration of forest health;

A determination that the burn does or does not meet the criteria for exemption.

If the auditor determines that the exemption does not apply to a burn the exemption for the burn will be rescinded.

If the audit reveals that the landowner has systematically inappropriately applied the exemption, the landowner's total exempted burning emissions will be adjusted by the proportion of the audited burns that have the exemption rescinded.

Examples:

1. The landowner requests the exemption for forty burns. Ten are audited. One request for exemption is determined to be invalid. The exemption is rescinded for that one burn.

2. The landowner requests the exemption for forty burns. Ten are audited. Three requests for exemption are determined to be invalid. It appears the landowner has inappropriately applied the exemption. Thirty percent of the audited burns are not entitled to the exemption. The total exempted emissions are reduced by 30 percent.

VI. PUBLIC NOTIFICATION

Acceptance of forest health burning will depend on educating the public about the reasons for forest health burning and notifying the local community when forest health burning is to occur. Upon approval of the request by the DNR and before burning, the landowner is encouraged to notify the public in the vicinity of the burn of the general location and approximate time of ignition.

VII. ANNUAL REVIEW

The success and credibility of the Smoke Management Plan depends on the responsible and justifiable use of the forest health burning exemption. Interested members of the Smoke Management Plan Advisory Committee will meet annually to review the previous year's forest health burning and to evaluate the success of these guidelines in meeting the intent of the legislation.

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APPENDIX 17

Effect of Guidelines for Estimating Volume, Biomass, and Smoke Production for Piled Slash (PNW-GTR-364) on the Emissions Baseline

Background

The Guidelines for Estimating Volume, Biomass, and Smoke Production for Piled Slash (PNW-GTR-364) published in February 1996, contains a significant change in procedure for estimating volume of piled ponderosa pine slash. Piles of ponderosa pine were found to have a ratio of solid wood to volume ratio of 10 percent. The smoke management procedures implemented in February 1993 use a packing ratio of 20 percent for all species. Applying the new guidelines will result in calculated particulate emissions being reduced by half for piled ponderosa pine slash.

This appendix estimates the impact of applying the new data on the emissions inventory and the silvicultural burning emissions baseline and documents the decision not to adjust the emissions baseline.

Impact on Baseline

Applying the new ratio to the baseline would reduce the baseline by 2 percent, from 17,365 to 16,969 tons of PM 10.

	Total	***Tons pine***	***Est. tons***	***Adj. tons***		***Adj. Total***	
	PM 10	***pile burns***	***pine pile***	***pine pile***	***Adj. Pine***	***PM 10***	
Year	*Tons*	***over 100***	***under 100***	***burns***	***PM 10***	*tons*	***% change***
1985	***21308***	***32774***	***16879***	***24826***	***261***	***21047***	***-1.2%***
1986	***19257***	***47328***	***24374***	***35851***	***376***	***18881***	***-2.0%***
1987	***15976***	***46251***	***23819***	***35035***	***368***	***15608***	***-2.3%***
1988	***14953***	***45325***	***23342***	***34334***	***361***	***14592***	***-2.4%***
1989	***15329***	***76758***	***39530***	***58144***	***611***	***14718***	***-4.0%***
Averag	***17365***				***395***	***16969***	***-2.4%***

Impact on Historical Inventory

Burning piled ponderosa pine slash has not decreased as much as burning in other forest types. Consequently, burning pine slash represents an increasing proportion of total burning. Applying the new packing ratio will reduce total inventoried emissions by at lest 5% from 1990 forward.

	Total	*Tons pine*	*Est. tons*	*Adj. tons*		*Adj.*	
	PM 10	*pile burns*	*pine pile*	*pine pile*	*Adj. Pine*	*PM 10*	
Year	*Tons*	*over 100 tons*	*under 100*	*burns*	*PM 10*	*tons*	*% change*
1985	*21308*	*32774*	*16879*	*24826*	*261*	*21047*	*-1.2%*
1986	**19257**	**47328**	**24374**	**35851**	**376**	**18881**	**-2.0%**
1987	**15976**	**46251**	**23819**	**35035**	**368**	**15608**	**-2.3%**
1988	**14953**	**45325**	**23342**	**34334**	**361**	**14592**	**-2.4%**
1989	**15329**	**76758**	**39530**	**58144**	**611**	**14718**	**-4.0%**
1990	**12475**	**130041**	**66971**	**98506**	**1034**	**11441**	**-8.3%**
1991	**11130**	**75900**	**39089**	**57494**	**604**	**10526**	**-5.4%**
1992	**9392**	**74950**	**38599**	**56775**	**596**	**8796**	**-6.3%**
1993	**7912**	**74000**		**37000**	**389**	**7524**	**-4.9%**
1994	**5673**	**52000**		**26000**	**273**	**5400**	**-4.8%**
1995	**6382**	**73714**		**36857**	**387**	**5995**	**-6.1%**
1996	**5956**	**62857**		**31429**	**330**	**5626**	**-5.5%**

Summary

Applying the new ratio to the 1985 - 1989 baseline years would not change the baseline significantly, only about 2 percent. Ponderosa pine slash was a much smaller part of total emissions in the 1980's than later years. Ponderosa pine slash is likely to represent a larger proportion of burning in the future. We will implement the new procedures to improve the accuracy of our inventory in the future. Adjusting the baseline and the confusion that might create is not warranted.

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APPENDIX 18

CRITERIA FOR DEFINING LOW RISK AREAS

Background

The threshold for a large burn requiring smoke management approval has been set at 100 tons since the first smoke management plan was developed in 1970. Over time this threshold has proven to be adequate for broadcast burns. The 100-ton threshold has had some unintended consequences for pile burning. Landowners can burn large acreages of piles in less than 100 ton segments over many days without smoke management approval. This is not possible with most broadcast burning because they are usually greater than 100 tons and units cannot usually be segmented. The result of segmenting pile burn units is that a unit that would have been burned in one day with the smoke dispersed in one day may be burned over several days with local smoke impacts lasting for days. Segmenting also leads to an increased risk of wildfires when the piles being burned are next to unburned piles in the same unit.

When the 100-ton threshold was established, most large burns were broadcast burns. Pile burning produces less emissions per ton of debris than broadcast burning. In terms of PM_{10} particulate emissions, a pile burn produces only 38% as much PM_{10} per ton of fuel as a broadcast burn[7].

The practice of segmenting pile burn units creates administrative problems for DNR. Currently a landowner may burn as many under 100-ton segments at one time as they wish, while larger burns may only be burned with smoke management approval. The result is that more burning may occur when large burns are disapproved than when a large burn is approved. Additionally, it is not practical for DNR to track where and when each of these small segments are burning on any given day. In some remote areas pile burns up to 300 tons have negligible impact and are virtually always approved. In these areas the smoke management approval process represents an unnecessary regulatory requirement.

[7]Source: Compilation of Air Pollutant Emission Factors AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources.

Purpose

The purpose of this procedure is to define low risk areas where the threshold of burning requiring smoke management approval can be set to 300 tons of piled debris per landowner within a DNR district.

Low risk areas are remote areas, and areas generally above the inversion a different threshold for large burns will be applied. In these areas a private landowner may burn up to 300 tons of piled debris total per day on their ownership within a DNR district without smoke management approval subject to the conditions of their written burn permit or restrictions recorded on the toll-free burn information line. On federal lands, a land manager may burn up to 300 tons of piled debris total per day within a ranger district without smoke management approval subject to restrictions recorded on the toll-free burn information line.

DNR Regions will define the low risk areas using the criteria described in this appendix.

In all other areas the threshold for large burns requiring smoke management approval will remain at 100 tons per burn.

Goals

The Goals of this procedure are to:

Reduce the incentive to divide pile burns into under 100-ton segments,

Obtain better control of the amount of burning occurring in an air shed under less than optimal conditions,

Eliminate an unnecessary regulatory requirement.

Criteria

These criteria are general guidelines for defining remote areas where the threshold may be raised to 300 tons per ownership. Regions are expected to use their judgment and local knowledge when mapping low risk areas.

West of Interstate 5:

Low risk areas will be at least five miles from the nearest community.

East of Interstate 5:

Low risk areas will be at least 1,000 feet above major valley bottoms. This will be approximately 1,500 feet elevation in the west slopes of the Cascades, and 3,000 feet elevation in eastern Washington.

Implementation

The low risk area designations will be applied beginning January 1, 1999.

DNR Regions will provide Resource Protection Division with maps of the low risk areas by January 1, 1999.

Resource Protection Division will help with mapping by providing meteorological expertise on request from the regions.